TECHNOLOGY DEPT.

TECHNOLOGY REVIEW

March 1958

No. 3 in a series

Right off the Wire

A new system using multiple cathodes is said to double the life of the vapor lamps used on highways.

A thermionic converter has been made that produces electricity directly from heat with an efficiency of eight per cent.

Studies of the northern lights being made with a high-powered, long-range radar may disclose a method of defense against missiles coming over the arctic.

Submarine cable can be made in any length at the Simplex Submarine Cable Division's dockside plant. Single lengths are limited only by the capacity of a cable ship's hold, or the length of a train of gondola cars.

An electronic system of bank record keeping handles random-sized, unpunched paper checks at the rate of 1800 checks per hour to 40,000 accounts.

The world's largest solar furnace is being designed for installation in New Mexico. It will produce temperatures as high as 8,000°F.

Elimination of thermal noise by operating microwave amplifiers at the temperature of liquid helium has been found to greatly increase the range of radar.

An electronic map plotter is expected to make possible more accurate and cheaper maps from aerial photographs and to lend itself to the automation of mapping.

Plans are being made to mount telescopes on balloons in order to make observations above the interference of the earth's atmosphere.

The U. S. Air Force has patented an infrared television camera for use at night or in fog.

A new chemical plant will need no outside source of fuel after operation has begun. All the heat required will come from the process.

It has been found that one area of the human brain contains a record of every detail of the person's experience. Total recall can be produced by the stimulation of a minute electrical pulse.

Phosphors applied to textiles, sheet materials or metal mesh light up when a current is passed through them thus making draperies, for example, sources of illumination.

A new microscope for the study of living tissues uses bursts of ultraviolet light too brief (one thousandth of a second) to injure the tissue. The image appears in color on a television screen.

A new drug promises to save the lives of many persons who might otherwise die from lethal doses of radiation. It has been tried only on laboratory animals.

A form of fiber glass containing uranium 235 has been developed as a fuel for atomic furnaces.

A new amplifier is expected to extend the range of radio telescopes about ten times, enough to equal the best optical instruments.

A giant air mattress, equipped with arresting and launching gear, has been patented for use as a portable airstrip. On it planes could make belly landings without damage.

Tellurium lead cable sheath has excellent vibration, creep and age-hardening resistance, and greater flex life and tensile strength than other lead alloys, say Simplex scientists after exhaustive tests.

A new meter for oil pipelines will measure a flow of 10,000 barrels per hour (four times the capacity of present equipment) with an accuracy of one tenth of one per cent.

Simplex C-L-X (Sealex) metallic sheath is manufactured with thermoplastic covering in colors for voltage or general industrial coding.

A device called an "electronic sentry" guards against fire, abnormal pressure, high or low water levels, temperature changes and other hazards. It calls a designated person by telephone and gives a pre-recorded message.

"Tree" of Knowledge

This strange looking growth tells an important story to the expert eyes of Simplex scientists. It's a Simplex photomicrograph showing "treeing" effect that results when a 15 KV polyethylene-insulated cable is broken down by 100,000 volts. This is typical of the continuing research work done at Simplex.

If you are interested in the important facts that Simplex scientists Kitchin and Pratt have discovered on polyethylene treeing, write for their AIEE Paper No. 58-121.

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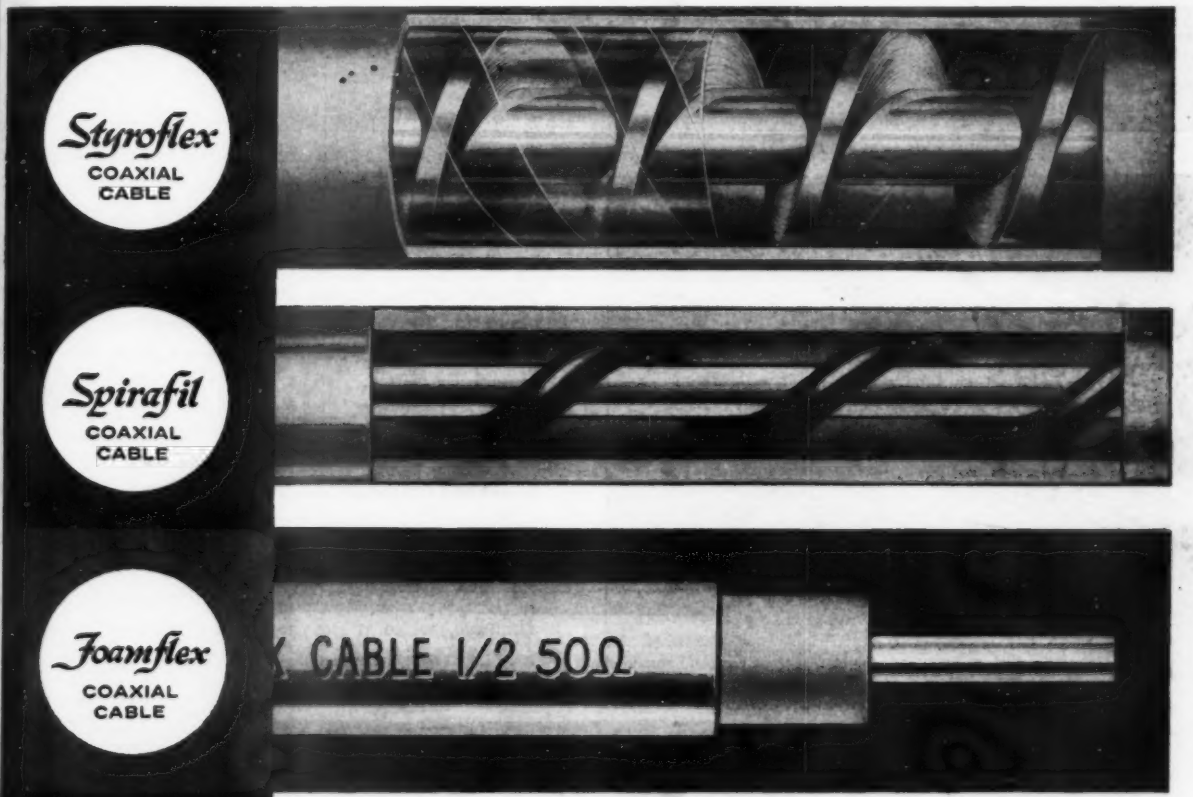

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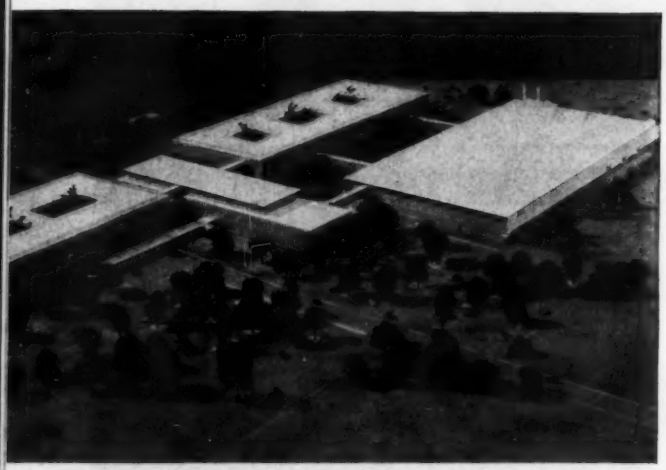
THE TECHNOLOGY REVIEW, March, 1958, Vol. LX, No. 5. Published monthly from November to July inclusive at Emmett Street, Bristol, Conn., Publication date: twenty-seventh of the month preceding date of issue. Annual subscription, $4.00: Canadian and Foreign subscription, $4.50. Entered as second-class matter December 23, 1949, at the Post Office, at Bristol, Conn., under the Act of March 3, 1879.

Dennis W. Holdsworth



Pictured above is our new Research and Development Center now under construction in Wilmington, Massachusetts. Scheduled for completion this year, the ultramodern laboratory will house the scientific and technical staff of the Avco Research and Advanced Development Division.

Avco's new research division now offers unusual and exciting career opportunities for exceptionally qualified and forward-looking scientists and engineers.

Write to Dr. R. W. Johnston, Scientific and Technical Relations, Avco Research and Advanced Development Division, 20 South Union Street, Lawrence, Massachusetts.

IDEALS AND PRACTICALITY

"Science and Philosophy mutually criticize each other and pro imaginative material for each other."... Alfred North Whitel

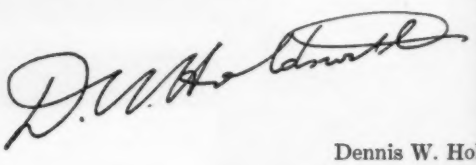
In the increasing preoccupation of science with material thi and progress, the truth of this statement by one of our grea philosophers is often overlooked and forgotten. The scien philosopher is a rare being and is becoming rarer still, nor he be adequately replaced by the group technique or 'brainstorm' session.

It should be one of the noblest aspirations of all our scie to provide for the true contemplation of the inner meanin facts and to stimulate that interplay of mind on mind which alone we may progress.

In all these things, however, we cannot forget the probl peculiar to research and development in private industry. obligation to work to otherwise-determined time-scales p a nice problem in balancing ideals against the practical of everyday life.

It is in this field that the test of management comes. Its su at meeting such continuously conflicting requirements de mines the character and ultimate success of the organiza

With such thoughts as these in mind, we here at Research Advanced Development Division of AVCO are seeking un people. We wish to foster the creative minds and fundame thinkers, while preserving an atmosphere of self-discip free from a rigid hierarchy of command and organization.



Dennis W. Holdsw

Manager, Computer and Electronic Systems Depar

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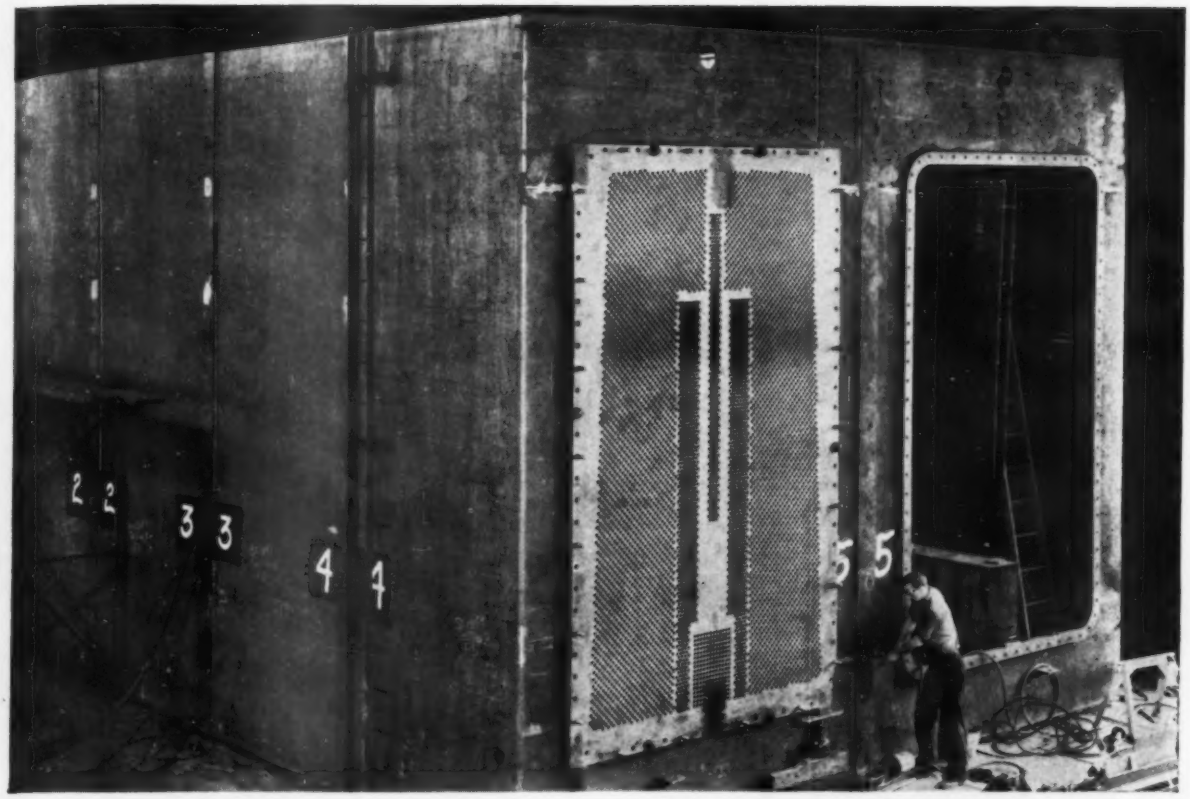

HERE'S ONE SHELL of this twin-shell, triple-lane unit just before shipment to Consolidated Edison's Astoria Station. It's designed to condense 1,600,000 lbs. steam/hr. at 1.87" Hg., with 244,000 gpm circulating water, and has 27,450 aluminum-brass tubes. Unit serves 335,000 kw turbine.

HUGE, SINGLE-PASS, 187,000 sq. ft. CONDENSER

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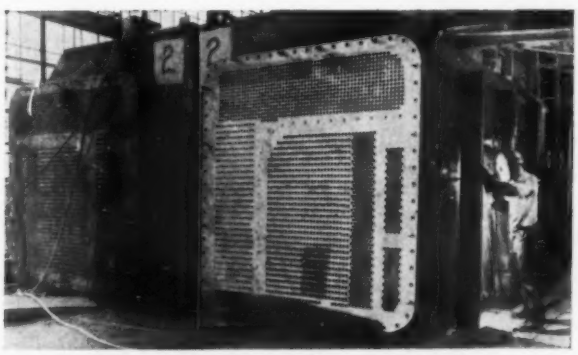

TYPICAL REVERSE FLOW CONDENSER is this 35,000 sq. ft. unit for a Southern electric utility. Patented Reverse Flow feature permits flushing debris from tubes with only slight (and momentary) vacuum loss. Note low height to save head room, rectangular cross section to further utilize space for this Wheeler client.

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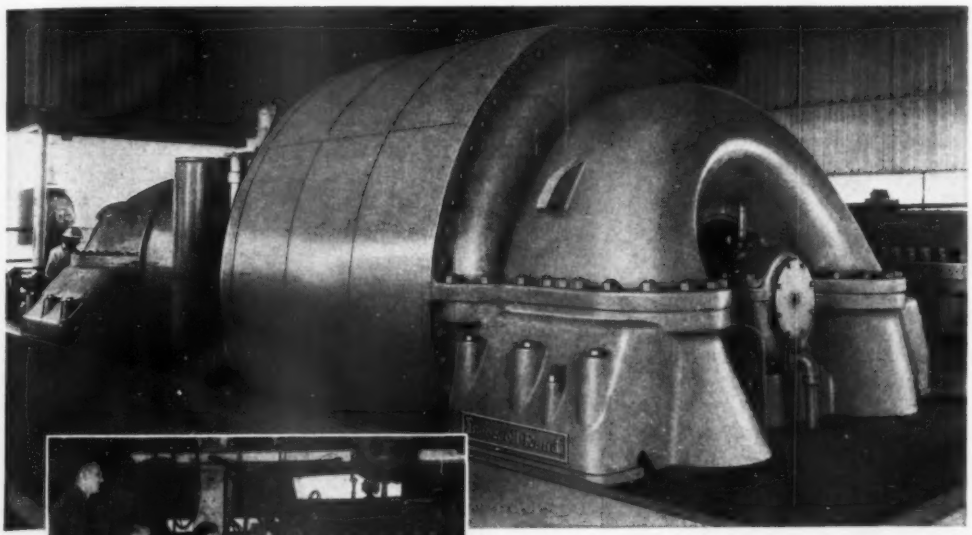
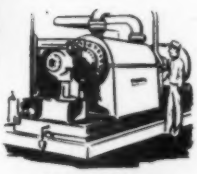


ABOVE: This huge I-R Turbo-Blower is the largest cat-cracking air blower ever built. It delivers 161, 500 cfm of 30 psi air at Tidewater Oil Company's new Delaware refinery, and is driven by an 11,250 hp I-R steam turbine.

LEFT: Engineering trainees at Ingersoll-Rand's Phillipsburg, N. J., plant check final performance tests on another blower of smaller size and higher pressure.

also means LEADERSHIP in



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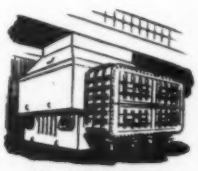
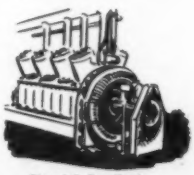


Steam Condensers



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THE TABULAR VIEW

Answers to Sputnik? – Artificial earth satellites, whether placed in their orbits by the United States or by other nations, forcefully bring to our attention the need for developing this nation's scientific potential as completely as possible. One proposal for helping to achieve this aim is given (page 251) by ARTHUR R. VON HIPPEL, Professor of Electrophysics, who established, and is the director of, the Institute's Laboratory for Insulation Research. The work of this Laboratory cuts across many fields, such as physics, chemistry, mathematics, mechanical engineering, and electrical engineering, for example. It is not surprising, therefore, that Professor von Hippel proposes the establishment of federally sponsored university research centers, operating on a truly interdepartmental level, as a means of strengthening science for national defense. Professor von Hippel received the Ph.D. degree from the University of Göttingen in 1924, and was Rockefeller Fellow, University of California at Berkeley in 1927–1928. He taught at the University of Jena (1928-1929), the University of Göttingen (1929–1933), the University of Istanbul (1933–1934), and the University of Copenhagen 1935–1936).

Dignity of Individual. – The mass-production techniques of the Twentieth Century, and the co-operative teamwork which is thereby entailed, leaves little time – and perhaps less interest – to examine critically the role of the individual in today's society. In his essay on "The Dignity of the Individual in the Twentieth Century" (page 253), JOHN B. WILBUR, '26, Professor of Civil Engineering, expresses concern for the effect of technological progress on the dignity of the individual. The most meaningful province of private enterprise is universal moral discipline, concludes Professor Wilbur, who adds that members of a free society can – and will – give their devotion to the common cause. Professor Wilbur received the S.B., S.M., and Sc.D degrees from M.I.T. in 1926, 1928, and 1933, respectively. He was assistant in the Department of Civil Engineering between 1926 and 1928, and then joined the engineering staff of the Maine Central Railroad Company. From 1929 to 1930, he was bridge designer for the New York Central Railroad Company. In 1930, Dr. Wilbur returned to M.I.T. as instructor in Civil Engineering. He was made assistant professor in 1934, associate professor in 1937, and professor of structural engineering in 1943. In 1946 he was made head of the Department of Civil and Sanitary Engineering, after having served for two years as its acting head. In addition to his professional achievements, Dr. Wilbur is perhaps best known, at least among Technology Alumni, for his composition "Sons of M.I.T."

Tomorrow's Table. – What will America's increasing population be having for dinner a decade or two hence? The nonspecialists in foods may have a difficult time answering this question. But to food spe-

(*Concluded on page 236*)

BIG GUN IN STAINLESS

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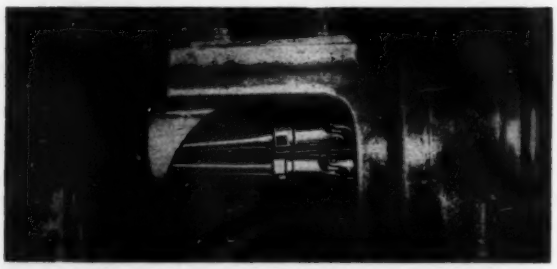

The manufacturer of this button-drilling machine had a tough problem: the universal joints on these parallel shafts carried such a torque load there were frequent complaints of breakage . . . yet the close centers prohibited use of a larger joint. **The solution** was a Curtis Universal Joint of the same size but higher torque.

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THE TABULAR VIEW

(Concluded from page 234)

cialists like Bernard E. Proctor, '23, and Samuel A. Goldblith, '40, of the Institute's Department of Food Technology, such prognostication is not difficult. These authors remind us (page 255) that many products common to the American dining table 10 years from now will have achieved acceptability because of research now going on in food technology. The Review article is a printed version of a paper presented at the Conference on New Directions in Food Marketing, held at the School of Retailing, University of Pittsburgh, on April 5, 1957.

Professor Proctor received the S.B. and Ph.D. degrees from M.I.T. in 1923 and 1927, respectively. Between 1923 and 1926 he was an instructor in biochemistry in the School of Medicine, Boston University. Since 1926 he has been a member of the M.I.T. staff: first as assistant and instructor, and later as a member of the Institute's Faculty. He became professor of food technology in 1944, and the following year became director of the Samuel Cate Prescott Laboratories of Food Technology. Since 1952 he has been head of the Department of Food Technology. He is author of many technical papers and, with Samuel C. Prescott, '94, wrote *Food Technology*, published by the McGraw-Hill Book Company, Inc.

Professor Goldblith received the S.B., S.M., and Ph.D. degrees from M.I.T. in 1940, 1947, and 1949, respectively. He was a member of the staff of Arthur D. Little, Inc. in 1940–1941, and served with the United States Army from 1941 to 1946. He joined the M.I.T. staff as a research associate in 1949, was made assistant professor of food technology in 1952, associate professor in 1955, and became executive officer of the Department of Food Technology also in 1955. He is the author of numerous articles in professional journals in the field of nutrition, and is associate editor of *Food Technology*.

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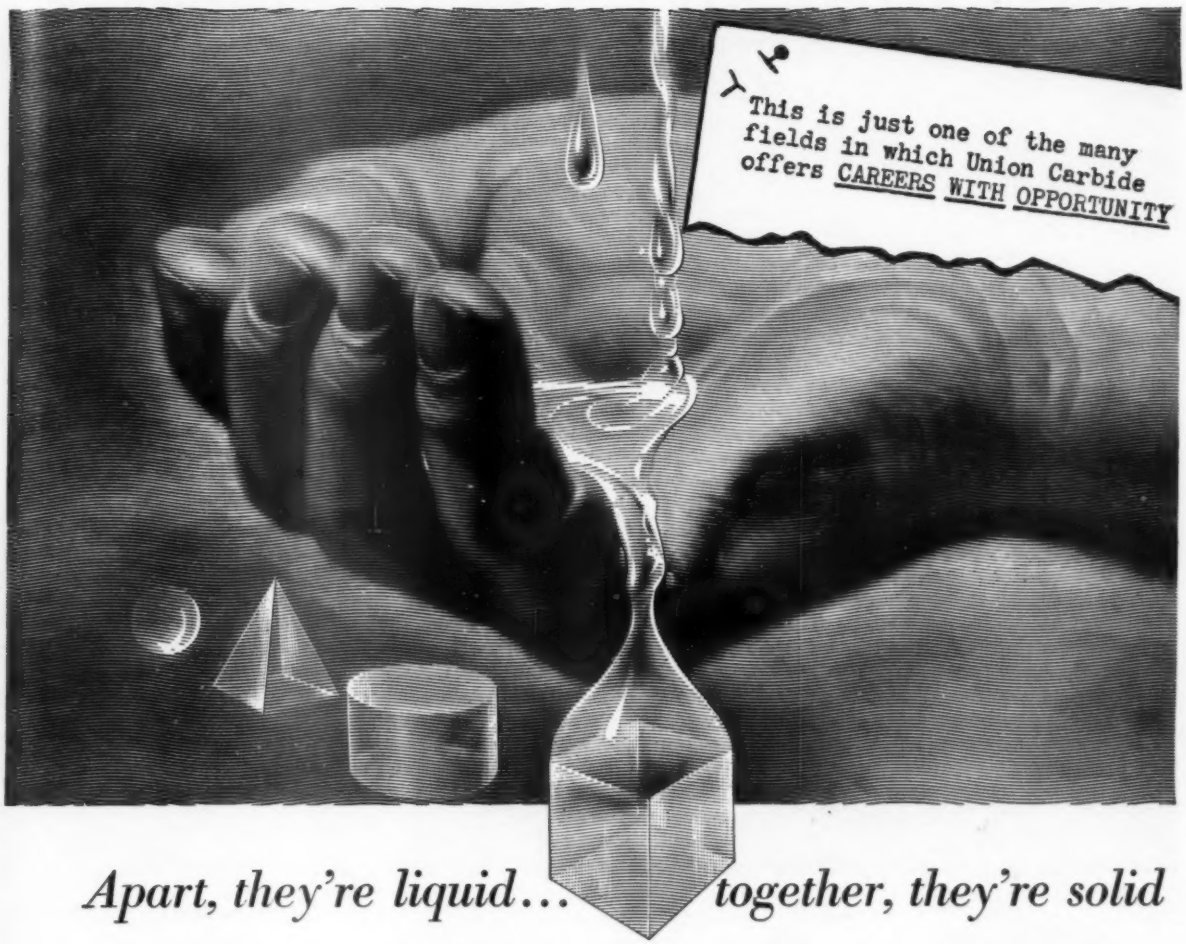

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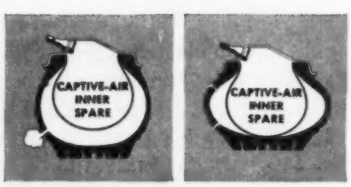

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THE TECHNOLOGY REVIEW

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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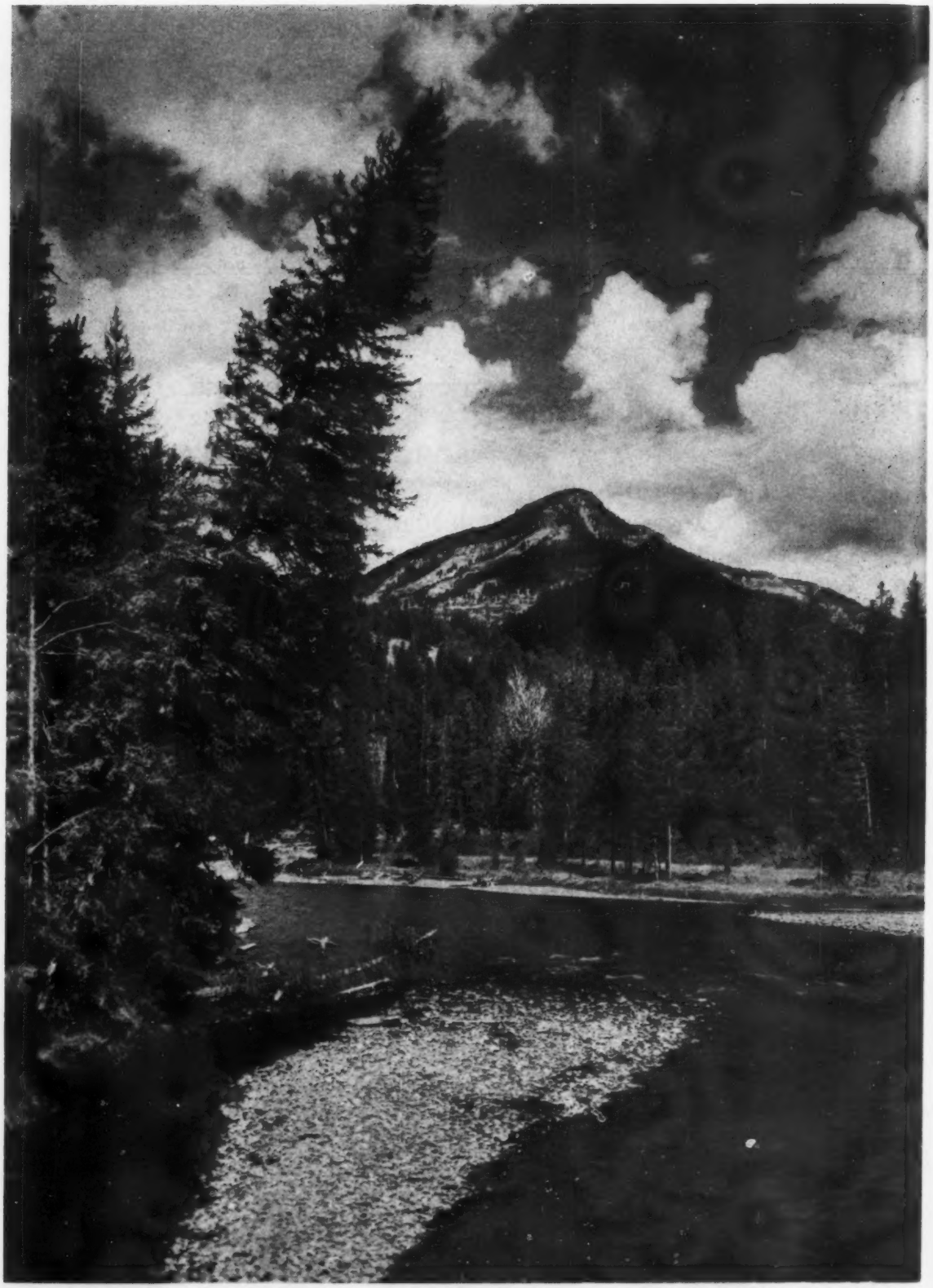
Palace in ancient Thebes, Upper Egypt on the Nile.

Photograph by Kenneth E. Bell, '17

Published monthly from November to July inclusive on the twenty-seventh of the month preceding the date of issue, at 60 cents a copy. Annual subscription, $4.00; Canadian and foreign subscription, $4.50. Published for the Alumni Association of the M.I.T.: Gilbert M. Roddy, President; H. E. Lobdell, Executive Vice-president; John J. Wilson, D. Reid Weedon, Jr., Vice-presidents; Donald P. Severance, Secretary-Treasurer. Published at Hildreth Press, Inc., Bristol, Conn. Editorial Office, Room 1-231, Massachusetts Institute of Technology, Cambridge 39, Mass. Entered as second-class mail matter at the Post Office at Bristol, Conn. Copyrighted, 1958, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect change of address, for which both old and new addresses should be given.



". . . Let me court the rivers and forests."
— Virgil

North Fork, Shoshone River, east of Yellowstone Park — camera view by F. S. Lincoln, '22

The Technology Review

VOL. 60, NO. 5 MARCH, 1958

The Trend of Affairs

Getting Out the Vote

■ In keeping with American tradition, the elective process will go into operation this spring as Technology Alumni mark their ballots for officers of the M.I.T. Alumni Association, alumni term members to serve on the Institute's Corporation, members of the National Nominating Committee, and (for classes whose numerals end in four or nine) class representatives to serve on the Alumni Council. Ballots calling for the election of these officers will be put into the mail on March 24, will be counted on April 25, and the results of the election will be announced in the June, 1958, issue of The Review.

Nominated to serve as president of the M.I.T. Alumni Association for one year beginning July 1, 1958, is John J. Wilson, '29, XV, Director of the Minneapolis-Honeywell Regulator Company. Other posts and achievements of this distinguished Alumnus are recorded in the legend of Mr. Wilson's portrait.

Nominated to serve as a vice-president for a two-year term beginning July 1, 1958, is William W. Garth, Jr., '36, XV. Mr. Garth is president and treasurer of Photon, Inc., as well as president, treasurer, and director of the International Photon Corporation, and Graphic Arts Research Foundation, Inc., developers of photographic methods for setting type. Mr. Garth is a director of Baird-Atomic, Inc., Chemical Products Corporation, and Imtra Corporation. He is a member of the corporation of Northeastern University, the Museum of Science, and the Home Savings Bank of Boston. He has been active in alumni activi-

1958–1959 Presidential Nominee . . .

John J. Wilson, '29, XV, heads the ballot of the Alumni Association for officers whose terms begin on July 1, 1958. Mr. Wilson at present is director of the Minneapolis-Honeywell Regulator Company; in 1954-1957, he was vice-president of this company. He had had previous executive experience as president and director of Doelcam Corporation in 1945-1955 and of Datamatic Corporation in 1955-1956. Also, from 1941 to 1945, he was general purchasing agent for the Sperry Gyroscope Company.

Notwithstanding the claims of industry on his time, he has maintained a keen interest in affairs of the Institute and the Association, serving as vice-president of the Alumni Association during 1955-1957. Mr. Wilson has been a member of the Alumni Council since 1950 and Class Agent since 1951. In 1949 he served as chairman of the 20th Reunion for the Class of 1929, and over the years has been chairman and member of numerous Association committees, as well as chairman of the First Alumni Officers' Conference in 1955 and of the M.I.T. Centennial Committee, 1956-1957. In 1955-1957 he was a member of the Alumni Fund Board.

A civic interest is the Children's Hospital in Boston, of which he is a corporation member. Mr. Wilson is a director of: the Second Bank-State Street Trust Company, Boston; Forbes Lithograph Company, Chelsea; Associated Industries of Massachusetts; Greater Boston Chamber of Commerce; and the Skating Club of Boston. He is a member of the M.I.T. Faculty Club, Algonquin Club, St. Botolph Club, Brae Burn Country Club, Minneapolis Club, Cruising Club of America, Eastern Yacht Club in Marblehead, and the Cat Key Club, B.W.I.

Fabian Bachrach

Douglas Aircraft Company, Inc. *Moffett, Chicago*

Nominees for alumni term membership on the Institute's Corporation, each to serve for a term of five years, are (from left to right): *Donald W. Douglas, '14, Chairman of the Board and President, Douglas Aircraft Company, Inc., Santa Monica, Calif.; Robert C. Gunness, '34, Executive Vice-president, Standard Oil Company (Indiana); and Gilbert M. Roddy, '31, President and Director, Boston Manufacturers Mutual Insurance Company, and President and Director, Mutual Boiler and Machinery Insurance Company, Waltham, Mass.*

ties for many years. He has represented the Class of 1936 on the Alumni Council since 1946; was secretary of his Class from 1947 to 1950; and class agent, 1946–1951. He was a member of the Executive Committee, 1950–1952, and member of the Alumni Fund Board, 1953–1957. He also was a member of the Alumni Council, representing various M.I.T. clubs in 1937–1938, and again from 1943–1946; Friends of the M.I.T. Library Committee, 1946–1953; Personnel Committee, 1946–1950; Advisory Council on Athletics, 1946–1948; Advisory Council on Undergraduate Government, 1949–1952; Alumni Day Committee, 1950–1951; Library Departmental Visiting Committee, 1950–1954; chairman, Midwinter Meeting Committee, 1951–1952; and member of the Committee on Nominations for Departmental Visiting Committees, 1954–1957. Mr. Garth is a member of the St. Botolph Club (Boston), University Club (New York), and the Concord Country Club.

Nominated to serve on the Executive Committee of the Association for a two-year term beginning July 1, 1958, are the following two Alumni: F. Leroy Foster, '25, III, Director of the M.I.T. Division of Sponsored Research; and Philip H. Peters, '37, VI–A, Vice-president of the John Hancock Mutual Life Insurance Company, Boston.

Nominated to serve for five-year terms, as alumni term members on the M.I.T. Corporation, are: Donald W. Douglas, '14, II, Chairman of the Board and President, Douglas Aircraft Company, Inc., Santa Monica, Calif.; Gilbert M. Roddy, '31, XV, President and Director, Boston Manufacturers Mutual Insurance Company, and President and Director, Mutual Boiler and Machinery Insurance Company, Waltham, Mass.; and Robert C. Gunness, '34, X, Executive Vice-president, Standard Oil Company (Indiana).

The membership of the National Nominating Committee at present is comprised of: Horatio L. Bond, '23, chairman, Robert C. Erb, '17, Edmund D. Ayres, '22, Clayton D. Grover, '22, Cecil H. Green, '23, Max L. Ilfeld, '24, Ralph B. Johnson, '27, Bissell Alderman, '35, Harold Chestnut, '39, and Henry Avery, '41.

Nominations for members of the National Nominating Committee (with one Alumnus to be elected from each of the following districts for a term of three years) are: *District 1* – Boston, Mass. – John A. Lunn, '17, II; *District 2* – Portland, Maine – Robert B. Follansbee, '32, I; Montreal, Que. – Jean M. Raymond, '34, XV; *District 4* – Schenectady, N.Y. – Philip L. Alger, '15, VI; Syracuse, N.Y. – Edwin A. Gruppe, '22, XIV; Rochester, N.Y. – Van Buren N. Hansford, '37, II; Toronto, Ont. – Maxwell C. Coutts, '39, XV; *District 5* – Newark, N.J. – Everett W. Vilett, '22, VI; New York City – Hartselle D. Kinsey, '24, X–A.

Lecture on Nuclear Reactor

■ Plans for operation of the nuclear reactor now nearing completion at the Institute were described in a lecture given three times (on the week-end of January 17) at M.I.T. by Theos J. Thompson, Associate Professor of Nuclear Engineering. The lecture was presented for the general public on Sunday afternoon, January 19, in Compton Hall of the new Karl Taylor Compton Laboratories. It was heard on January 17 and 18 by high school students.

Professor Thompson, who designed the reactor and has been director of its construction, showed slides explaining the fission process and the method by which it will be used in the reactor for research and experimental purposes in such fields as physics, medicine, chemistry and food technology. The reactor will be used for various purposes, among them, the study of nuclear fission; training of nuclear engineers; medical studies in the use of neutron beams for the treatment of disease, such as brain tumors; experiments in the sterilization of foods and medical supplies; experiments in improving the characteristics of materials; and studies of mechanical wear.

Before coming to the M.I.T. Faculty in 1955, Dr. Thompson served as a physicist at the Los Alamos Scientific Laboratory, where he worked on design and construction of the Omega West Reactor.

Council Views Educational TV

■ Activities of one of America's outstanding educational television stations, WGBH, were on the program of the first meeting of the Alumni Council for the calendar year 1958. Gilbert M. Roddy, '31, President of the Alumni Association, presided at this meeting (the 328th of this august body) on the evening of January 6 in the M.I.T. Faculty Club where 174 members and guests were present to consider the affairs of the Association, and to hear a discussion of M.I.T.'s participation in the Lowell Institute Cooperative Broadcasting Council, which operates Station WGBH on Channel 2 in Boston.

As Secretary of the Association, Donald P. Severance, '38, reported changes in class affiliation for two Alumni, and visits to 13 local clubs and to one M.I.T. regional conference by 21 members of the Council and of the Institute staff.

To date, results of the election of chairmen and committee members for Alumni Day, 1958, scheduled for Monday, June 16, are as follows: *Registration* – Wolcott A. Hokanson, staff, chairman, Robert E. Hewes, '43, G. Edward Nealand, '32; *Morning Conference* – James Donovan, '28, chairman, Samuel C. Prescott, '94, Eugene R. Smoley, '19, Arthur A. Nichols, '28, William C. Rousseau, '36, Louis Rosenblum, '42, Mrs. Karl T. Compton; *Luncheon* – Albert O. Wilson, Jr., '38, chairman, Waldo F. Pike, '15, Winthrop F. Potter, '22, Robert C. Dean, '26, William H. Carlisle, Jr., '28, Felix J. Conti, '34, C. Vincent Vappi, '48; *Afternoon* – Allen Latham, Jr., '30, chairman; *Banquet* – Philip H. Peters, '37.

Vincent T. Estabrook, '36, chairman of the Midwinter Meeting Committee, reported briefly on plans for the meeting to be held on February 4. Alumni were encouraged to bring as guests their school superintendents, principals, physics teachers, and school board members so that they could become acquainted with the work of the Physical Science Study Committee which would be demonstrated. This committee is developing new curricula, books, films, and experiments for the teaching of high school physics. (Please see page 250 for the report of the Midwinter meeting.)

Included in the remarks of Joseph E. Conrad, Regional Director of the Alumni Fund, was the report that participation in the Fund by Alumni Council members stands at 66 per cent; and that 7,125 Alumni have contributed $214,710 as compared to $206,603 given by 6,627 contributors for last year at the same time. Mr. Conrad also spoke of the regional personal solicitations to take place in 151 localities. In communities throughout the country, 2,000 solicitors will make personal calls for the Alumni Fund. Proved to be quite successful was the Class Special Gifts Solicitation Program which had been introduced this year on an experimental basis.

After the business meeting, Hartford N. Gunn, Jr., General Manager of WGBH, spoke on the collaboration of Station WGBH and M.I.T. in undertaking wider dissemination of information and knowledge. He cited as specific examples the program, Science Reporter, in which Volta Torrey, M.I.T.'s Director of Television, is host to distinguished men of science, presenting the goal and influence of science in the Twentieth Century; programs designed to examine before the television cameras the specific areas of scientific knowledge in which the particular scientist is most knowledgeable. The Lowell Institute Cooperative Broadcasting Council is so confident of the success of the Science Reporter programs that it is seeking additional support from business and foundations to distribute kinescope recordings of these programs each week to more than 30 educational television stations throughout the United States whose weekly audience is 12,000,000 or more.

Of the many facets of television programming disclosed by Mr. Gunn, perhaps the most startling concerned the recent North Atlantic Treaty Organization Conference. To the best of his knowledge, not one radio or television program in the United States, either on the great network or on local radio and television stations, presented a comprehensive report on what N.A.T.O. is, why a N.A.T.O. Conference was called, what was to be discussed, and how to interpret the outcome of the conference. The only exception that he could find was a program on WGBH-TV given the day preceding the N.A.T.O Conference when it presented Professor Walt W. Rostow, M.I.T. Professor of History, and Professor Lincoln Gordon of Harvard with Henry Morganthau, 3d, of the station in a clear and concise discussion of the N.A.T.O. Conference.

After Mr. Gunn's remarks, the Council viewed a 25-minute motion picture of a Science Reporter telecast by WGBH which took place immediately after the Russians launched their second satellite. In this program, Arthur R. Kantrowitz, Visiting Institute Professor, told how a dog or a man could be brought back alive from space, and described the shock tube used in his laboratory in connection with research in magnetohydrodynamics.

In conclusion of the meeting, Dr. Kantrowitz was interviewed in person, first by Mr. Torrey, and then by members of the Alumni Council during a question period.

On the Horizon

March 13–15, 1958 – 10th Annual Fiesta, M.I.T. Club of Mexico, Mexico City, D.F. (For reservations, consult Clarence M. Cornish, '24, Margaritas 139, Villa Obregon, Mexico 20, D.F., Mexico.)

April 1, 1958 – President's Dinner, M.I.T. Club of Chicago. (For reservations, consult Robert C. Meissner, '43, John F. Meissner Engineers, Inc., 308 West Washington Street, Chicago 6, Ill.)

April 12, 1958 – Spring Dinner, M.I.T. Club of Philadelphia, Longwood Gardens, Kennett Square, Pa. (For reservations, consult Samuel K. McCauley, '41, P. O. Box 298, Upper Darby, Pa.)

June 16, 1958 – 24th Alumni Day, 1958, M.I.T. Campus in Cambridge.

November 8, 1958 – 13th M.I.T. Alumni Regional Conference, Albuquerque, N.M.

M.I.T. Photo

Course XIV
Head

Robert L. Bishop
Head, Department of Economics and Social Science

Ralph E. Freeman
Professor of Economics

M.I.T. Photo

Heads Course XIV

■ Appointment of Robert L. Bishop as Head of the Department of Economics and Social Science at the Institute was announced recently by Chancellor J. A. Stratton, '23, Acting President. Dr. Bishop succeeds Ralph E. Freeman, who will continue as a professor of economics.

"Professor Freeman has served with distinction since 1934 as Head of a Department which had its beginning in the early days of the Institute and which during his administration became widely recognized for its teaching and research," said John E. Burchard, '23, Dean of the School of Humanities and Social Studies, of which the Department is a unit. "We are happy that he is to be succeeded by an economist of such stature as Professor Bishop," Dean Burchard remarked.

Professor Bishop received bachelor's, master's, and doctor's degrees from Harvard University and was an instructor and tutor in economics at Harvard for three years. He became an instructor in economics at M.I.T. in 1942, an associate professor in 1950, and a professor last summer. His special field is economic theory, and he has been a consultant for industrial concerns in the textile, automotive, and glass fields.

Professor Freeman, a native of Canada, served in the Royal Artillery during World War I. He studied at McMaster University and the University of Chicago and was a Rhodes scholar at Oxford University. For several years he was in private business and a member of the faculty of the University of Western Ontario. He joined the M.I.T. Faculty in 1931 and became head of the Department of Economics and Social Science in 1934.

Willis R. Whitney: 1868–1958

■ Willis R. Whitney, '90, former director of the General Electric Research Laboratory, Emeritus Professor of Chemical Research at M.I.T., and an Emeritus Life Member of the M.I.T. Corporation, died in Schenectady, N.Y., on January 9. He was 89 years old.

Dr. Whitney was considered the dean of industrial research in this country. His work as founder and developer of the General Electric Research Laboratory set the pattern for industrial scientific laboratory research work throughout the United States. His personal achievements as a chemist, inventor, educator, and engineer were important, but in addition, scientists working under Dr. Whitney developed the modern electric light bulb and did significant work in such fields as x-rays, radio, television, large turbine generators, and submarine detection. Dr. Whitney directed the Research Laboratory in Schenectady from 1900 until 1932, when he retired from the laboratory. He continued active service with the General Electric Company as vice-president in charge of research, and in 1941 became an honorary vice-president and also consultant on research to the company.

Awarded his S.B. by M.I.T. in 1890 and his Ph.D. by the University of Leipzig, Germany, in 1896, Dr. Whitney joined the M.I.T. teaching staff in 1890 and held a nonresident professorship after 1904. He was elected a term member of the Institute's Corporation in 1917 and 1923, and served as life member from 1938 until 1954.

Honored many times, Dr. Whitney held five honorary degrees and received the Willard Gibbs Medal of the American Chemical Society in 1916, the Chandler Medal of Columbia University in 1920, the Perkin Medal of the American Section of the Society of Chemical Industry in 1921, the Franklin Medal in 1931, the Edison Medal in 1935, the Public Welfare Medal of the National Academy of Sciences in 1938, the John Fritz Medal in 1943, and the Medal of the Industrial Research Institute in 1946. He was made a Chevalier of the Legion of Honor of France in 1937, and was a member of the National Academy of Sciences, past-president of the American Chemical Society, and past-president of the American Electrochemical Society.

Educational Council Secretary

■ The appointment of D. Hugh Darden as Executive Secretary of the M.I.T. Educational Council was recently announced by J. A. Stratton, '23, Acting President. Formerly Assistant Director of Admissions at New York University, Mr. Darden will also have the additional title of Assistant Director of Admissions at M.I.T.

The Educational Council, which Mr. Darden now heads, is composed of about 700 M.I.T. Alumni who maintain liaison between the Institute and more than 1,000 secondary schools throughout the United States. The primary functions of the council members are to keep schools informed of educational developments at M.I.T., to advise students on educational opportunities in science and engineering, and to interview candidates for admission to M.I.T.

Since 1954 Mr. Darden has been with the Admissions Office at N.Y.U. where he was responsible for admissions to the school of engineering. He was also a Penfield Fellow in History at N.Y.U. from 1952 to 1954 and served as an instructor in history there during 1952–1953 and 1956–1957.

In World War II he served with the U.S. Army in Europe where he won a battlefield commission as a second lieutenant and received four campaign stars. Following the war he became a graduate teaching fellow at the University of Alabama (1946–1949) and later (1949–1952) an assistant professor of history at the state teachers college at Florence, Ala.

Born in 1922 in Lanett, Ala., he was educated in the public schools of West Point, Ga., and received the degrees of bachelor of arts (1943), bachelor of laws (1948), and master of arts (1949) from the University of Alabama.

Twenty-five Years Ago This Month . . .

■ The tides of the Atlantic Ocean were reproduced in an Institute laboratory, and made to ebb and flow at the will of Kenneth C. Reynolds, '25, and John B. Drisko, '27, who were engaged in studying their behavior in a model of the Cape Cod Canal.

As it then existed, the Canal, owned by the government, was a one-way sea-level waterway 100 feet wide and 25 feet deep, with a total length of about 7.5 miles. Under contemplated plans, it would be widened to 250 feet and dredged to a maximum depth of 30 feet, and have a lock to control the currents and make transit safe for all vessels.

Some idea of the complex problems involved in the investigation is indicated by the fact that the average rise and fall of the tide in Cape Cod Bay is five feet greater than in Buzzards Bay; and the tide time difference is three hours between the bays. Hence, the tide is rising in Buzzards Bay while it is falling in Cape Cod Bay. Under extraordinary conditions of flood tide driven by high winds, maximum differences in level of nine feet may occur between the bays. At high tide in Cape Cod Bay the water rushes southward to the lower level of Buzzards Bay; six hours later the current reverses and flows swiftly northward.

The laboratory model, in length 41.5 feet, was built to a scale of approximately 5.5 feet to one mile. It was constructed of concrete blocks to form a channel accurately reproducing the curving path of the Canal across the Cape. In its operation, time as well as size was reduced, for the complete cycle taking in nature approximately 12 hours was shortened in the model to a few minutes.*

■ Congratulations were being extended to *Francis R. Hart, '89,* upon his election to the Presidency of the United Fruit Company; . . . to *James Reed, '07,* named as General Manager of the Golden Gate Bridge and Highway District, California; . . . to *Robert E. Wilson, '16,* upon becoming Vice-president in charge of research, Standard Oil Company of Indiana;

To *Royal Barry Wills, '18,* upon being presented by President Hoover with the Gold Medal for the best small-house design submitted in the 1932 national competition sponsored by Better Homes in America;

To *Niazi I. Mostafa, '33,* upon winning the New England Intercollegiate wrestling title in the 155-pound class; . . . and to *Richard Bell, '34,* who had set a new intercollegiate record of seven seconds flat for the 70-yard dash, which equaled the world's record for that distance established by Loren Murchison in 1923.

*Two years later, in the spring of 1935, a larger 115-foot model was constructed to simulate conditions in the Canal if then contemplated plans were carried out – widening to 700 feet and dredging to a depth of 40 feet, thus causing an anticipated tidal flow of 75,000,000 gallons per minute compared with the existing estimated flow of 13,500,000 gallons per minute. This larger model was housed in "Building 20," a supposedly temporary, wooden relic of World War I, which was ultimately demolished in the summer of 1941.

M.I.T. Photo

A section of the 41.5-foot model of the Cape Cod Canal built in 1933 in the Institute's River Hydraulic Laboratory. The instrument, shown in the channel of the model, recorded changes in the water level accompanying the rise and fall of the tides as they occurred in the actual Canal.

Citation for Radio Education

■ Ralph Lowell, Trustee of the Lowell Institute, member of the M.I.T. Corporation, and pioneer leader in educational broadcasting, was awarded the annual citation of the New England District, American College Public Relations Association. The presentation was made on January 10 at the banquet of the A.C.P.R.A. New England district convention, meeting at the Institute.

The citation, which was presented by Miss Jean Glasscock, Director of Publicity at Wellesley College, described Mr. Lowell as one who "has summoned the vacuum tube to the service of education, extending the excitement of new ideas and the pleasure of learning from the lyceum halls of his grandfather's time into the homes of Boston and far up the Connecticut Valley.

"A banker by calling and a scholar at heart, he has kept a watchful guard over the quality that marks New England education, giving counsel and leadership to many institutions, and encouragement to all."

Mr. Lowell, who is president of the Boston Safe Deposit and Trust Company, was largely responsible for the formation in 1947 of the Lowell Institute Cooperative Broadcasting Council. The council now operates the only educational station in the country with both TV and FM broadcasting – WGBH-TV and WGBH-FM. Mr. Lowell is president of the WGBH Educational Foundation.

He is also a member of the Corporation of the Institute and of Northeastern University, a trustee of Boston University, and president of the Board of Overseers of Harvard University.

Soil Stabilization

■ Substantial and lasting improvements in the load-bearing capacity of the soil have important applications where the earth is usable as a load-supporting structure. Thus, "soil solidification," as it is commonly called, has important potential utility in the construction of highways, air strips, and dams, in the preparation of building foundations, and in the fabrication of earth housing. Because of its practical value, considerable effort has been expended on research for soil stabilizers that are economically feasible while simultaneously fulfilling the physical requirements of a specific application.

A solidifier suitable for use in preparing highway subgrades must be competitive in cost with that of excavating and removing existing soil and replacing it with suitable aggregate, and it must also lend itself to incorporation in the soil with conventional road-building equipment. For the construction of military air strips or emergency highways, on the other hand, a suitable solidifier might be relatively costly, but it must be rapid-acting, effective in low concentrations, and incorporable with soil under unfavorable conditions with lightweight processing equipment.

Recent research undertaken at the Institute's Soil Stabilization Laboratory by Alan S. Michaels, '44, Associate Professor of Chemical Engineering, with Peter M. Williams, '57, and Kendall B. Randolph, '56, research assistants in the Department of Chemical Engineering, was directed toward the development of chemical soil solidifiers for use in fine-grained soils of relatively high clay content. Such soils are often encountered in practice; while cohesive and strong in the dry state, they become weak and plastic when wet. No completely satisfactory method for solidifying fine clayey soils has been available in the past.

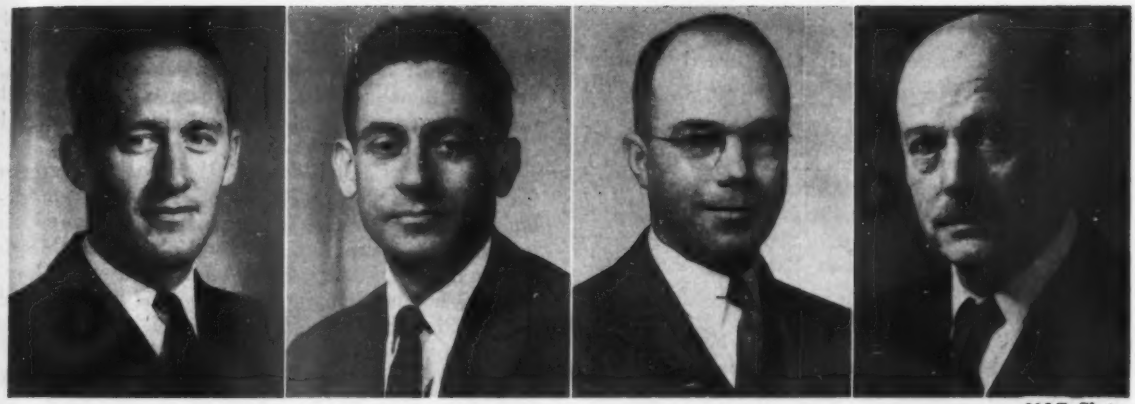
After establishing the ideal characteristics of a soil solidifier of wide utility for fine-grained soil, a preliminary investigation of potentially useful soil stabilizers indicated that phosphoric acid might meet several, if not most, requirements. Accordingly one objective of the M.I.T. research was to explore the suitability of phosphoric acid and a few other related compounds as soil solidifiers, and to attempt to determine under what conditions such materials might be most effectively utilized. Another objective of this study was to find secondary additives which, when used in connection with phosphoric acid in soils, would further enhance soil stability.

Five soils of widely differing composition were mixed with varying quantities of water and with between 2 and 10 per cent by weight of 90 per cent phosphoric acid (or P_2O_5), compacted statically to controlled density, allowed to cure under specified conditions for periods between six hours and 14 days, and immersed in water for specified periods. Unconfined compressive strength, density, and volatile content of the soil samples were measured both after cure and after immersion.

It was found that all soils studied could be successfully solidified with phosphoric acid, higher strengths being obtained with the coarser-grained soils, and larger quantities of acid being required for stabilization of the finer grained soils. Curing under humid conditions was found generally to yield stronger products (both as cured and after immersion) than curing under conditions where evaporation of water occurred. The strength of phosphoric acid treated soils reached significant levels in less than 24 hours of cure, and continued to increase to very high values for at least several weeks. However, soils so treated disintegrated when immersed in water immediately after compaction.

The most important variable affecting the strength of phosphoric acid stabilized soils appears to be the water content of the soil at the time of acid incorporation: Mixtures prepared at water contents only slightly higher than that yielding maximum soil density on compaction were found to have strengths markedly lower than those prepared at optimum water contents for maximum density. Phosphoric acid was found to facilitate mixing and compaction of soils, and hence optimum water contents for maximum strength development were slightly lower than the optimum for maximum compacted density of the untreated soil.

It is believed that phosphoric acid may have considerable promise as an economically realistic stabilizer for a broad spectrum of fine-grained soils, and that some of the shortcomings of phosphoric acid stabliization can be eliminated by the incorporation of trace amounts of amines, acidic organophosphorus compounds, and/or fluosilicates. Further studies along these lines are now in progress.



M.I.T. Photos

Distinguished professional awards in air science, as reported below on this page, were bestowed on four members of the Institute family. Shown above (from left to right) *are: Raymond L. Bisplinghoff, Professor of Aeronautical Engineering; Jule G. Charney, Professor of Meteorology; Henry G. Houghton, 27, Head of the Department of Meteorology; and Jerome C. Hunsaker, 12, Professor of Aeronautical Engineering, Emeritus.*

Awards in Air Science

■ Three Institute professors received distinguished professional awards at the annual honors night dinner of the Institute of the Aeronautical Sciences in New York on January 28. A fourth M.I.T. scientist was similarly honored at the annual meeting of the American Meteorological Society in New York on January 29.

At the meeting of the Institute of the Aeronautical Sciences, Jerome C. Hunsaker, '12, Professor of Aeronautical Engineering, Emeritus, received the Gold Medal of Britain's Royal Aeronautical Society "for his contributions to aeronautical research and education, including his inspired leadership of the National Advisory Committee for Aeronautics." Dr. Hunsaker served as first president of the I.A.S.

Raymond L. Bisplinghoff, Professor of Aeronautical Engineering, received the Sylvanus A. Reed Award for developing ways to calculate aircraft loads and stresses during maneuvers; and Jule G. Charney, Professor of Meteorology, the Robert M. Losey Award for research in the field of numerical weather prediction.

The American Meteorological Society honored Professor Henry G. Houghton, '27, Head of the Department of Meteorology, "for his important contributions to the growth of the Society." Dr. Houghton is both a past president and past secretary of the American Meteorological Society.

Dr. Hunsaker, who founded at M.I.T. the country's first course in aeronautical engineering, has been a member of the National Advisory Committee for Aeronautics since 1923 and served as its chairman from 1941 to 1956. His early work included supervision of the design of the *NC-4*, the first aircraft to fly the Atlantic Ocean, and of the airship *Shenandoah*. He became professor emeritus at the Institute in 1952.

Professor Bisplinghoff has been a member of the M.I.T. staff since 1946 and director of the Aeroelastic and Structures Research Laboratory there since 1952. He is an expert in the field of structural dynamics, and received the Sylvanus Reed Award for developing and systematizing techniques for calculating dynamic loads and stresses in aircraft structures.

Dr. Charney is a world leader in the field of numerical weather prediction. His work involves the use of giant computers in studying the physics of the atmosphere and in making weather forecasts. He previously received the Meisinger Award of the American Meteorological Society for his work in this field, and received the Losey Award for outstanding contributions to the science of meteorology as applied to aeronautics.

Dr. Houghton, who has been head of the Department of Meteorology at M.I.T. since 1945, is also director of the Laboratory of Earth Sciences there. He is well known for his research on the natural sources of condensation and of ice-forming nuclei, and their processes. In 1940 he was the first recipient of the Losey Award, which was conferred in January on his colleague Dr. Charney.

Biophysicists Meet at M.I.T.

■ The second national meeting of a new scientific society devoted to using physical and chemical science in the solution of biological problems brought about 500 physicists, chemists, biologists, physiologists, and engineers to the Institute on February 5, 6, and 7. Members of the new Biophysical Society, organized only 11 months ago, heard more than 200 technical papers during the three-day Cambridge meeting, ranging over the entire field of the new science of biophysics.

Harvard and M.I.T. were joint hosts for the meeting. Cyrus Levinthal, Professor of Biophysics at M.I.T., was chairman of the Society's program committee, and Arthur K. Solomon, Associate Professor of Biophysics at the Harvard Medical School, was in charge of local arrangements.

Sessions were held in Kresge auditorium at M.I.T., with a social hour at the Harvard Club of Boston on February 6.

Biochemistry, physiology, electron microscopy, genetics, cardiography, and radiology were among the many branches of science represented at the meeting.

Individuals Noteworthy

■ Featured in the news as the year turned were the 38 promotions, elections, or appointments set forth below:

Theodore F. Spear, '15, as a Director, National Association of Manufacturers . . . *Vannevar Bush, '16,* as Chairman of the Board, Merck and Company . . . *Edward C. Fales, '22,* as President, Gunite Foundries Corporation, Rockford, Ill. . . .

Edgar P. Dunlaevy, '24, as Executive Vice-president and a Director, Phelps Dodge Copper Products Corporation . . . *Ralph B. Norton, '25,* as Chief Engineer, Kerite Company . . . *William P. Lowell, Jr., '26,* as President, R.L.M. Standards Institute, Inc. . . .

Henry D. Johnston, '27, as Vice-president, Strathmore Paper Company . . . *Richard T. Davidson, '28,* as Investment Vice-president, Boston, Old Colony, and Boston Indemnity Insurance Companies . . . *Gerald A. O'Connor, '29,* as Vice-president, Raymond Concrete Pile Company . . .

Sidney L. Kaye, '30, as President, Parker Hill Medical Center, Boston . . . *Rear-Admiral Truman J. Hedding, '31,* as Bureau of Aeronautics General Representative, Western District (BAGR) . . . *Howard L. Richardson, '31,* as a Senior Vice-president, Sylvania Electric Products, Inc. . . .

Donald B. Sinclair, '31, as a Director, Institute of Radio Engineers, Inc. . . . *Thomas W. Regan, '32,* as President, General Box Company . . . *Charles P. Bowen, Jr., '35,* as a Director, Booz, Allen, and Hamilton International, Ltd. . . .

Manning C. Morrill, '39, as Vice-president for Operations, Cryovac Division, W. R. Grace and Company . . . *James H. Moore, '40,* as General Manager, National Research Corporation Equipment Corporation . . . *D. Louis Tonti, '40,* as President, American Bridge, Tunnel, and Turnpike Association.

James M. Austin, '41, as a Member of the Council, American Meteorological Society . . . *Kenneth G. McKay, '41,* as Director of Development, Solid State Devices, Bell Telephone Laboratories, Inc. . . . *John F. Wilson, '41,* as Vice-president in Charge of Sales, Metals and Controls Corporation . . .

Otto Zmeskal, '41, as Dean of Engineering, University of Toledo . . . *Richard D. Potter, '43,* as Director of Production and Production Engineering Department, United States Naval Powder Factory, Indian Head, Md. . . . *George L. Fichtenbaum, '47,* as Vice-president, Better Business Bureau of New York City . . .

Herbert C. Wieland, '47, as City Planning Director, St. Paul, Minn. . . . *John S. Anderegg, Jr., '49,* as President, Dynamics Research Corporation, Woburn, Mass. . . .

Billy E. Goetz, Professor of Industrial Management, as President, Academy of Management . . . *H. Guyford Stever,* Associate Dean, School of Engineering, as Vice-president, Institute of the Aeronautical Sciences, Inc.

■ In addition to those noted on page 247, special honors coming recently to Alumni and members of the Institute Faculty included:

To *Irving W. Wilson, '11,* Distinguished Life Membership, by the American Society for Metals . . . to *Charles J. McCarthy, '16,* and his associates of Chance Vought Aircraft, Inc., the Collier Trophy for "the greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the preceding year," by the National Aeronautic Association and *Look* magazine . . .

To *Harold F. Smiddy, '20,* the Henry Laurence Gantt Gold Medal, by the American Society of Mechanical Engineers . . . to *Manuel S. Vallarta, '21,* an honorary professorship, by the Universidad Mayor de San Andres, La Paz, Bolivia . . . to *Oscar H. Horovitz, '22,* honorable mention in the 1957 International Competition for his film "The Social Beaver," by the Photographic Society of America . . .

To *James H. Doolittle, '24,* an honorary doctorate of engineering, by the University of Michigan . . . to *Selden B. Spangler, '32,* election to the grade of Fellow, by the Royal Aeronautical Society of Great Britain . . .

To *Robert L. Kyhl, '47,* and *Arthur Karp, '50,* respectively, the W. R. G. Baker Award and the Browder J. Thompson Memorial Prize Award, by the Institute of Radio Engineers, Inc. . . . to *Wilbert E. Chope, '49,* named as one of the "Ten Outstanding Young Men of America for 1957," by the United States Junior Chamber of Commerce.

Solar Energy

■ Ever since 1938 when Godfrey L. Cabot, '81, contributed a substantial sum of money for the express purpose of studying the utilization of solar energy, an interdepartmental steering committee has directed study of practical methods of solar heating. Three experimental buildings have indicated the practicality of using solar radiation for home heating. A fourth solar house is now nearing completion in Lexington, Mass. Its construction marks a new step toward practical use of free energy for house heating.

Solar House IV is a very unusual dwelling, but not radical in its appearance, except for the south wall which is a glass-covered flat-plate radiant-energy collector. The collector has 640 square feet of area, slopes at an angle of 60 degrees to the horizontal and nearly touches the ground.

The energy absorbed by the collector will supply about 80 per cent of the total annual heating requirements. The remaining 20 per cent will be supplied by an auxiliary heating unit.

The lessons learned from earlier experiments have been as thoroughly utilized to design the new "sun home" for optimum performance and automatic, trouble-free operation as is possible at the present stage of technology. A wide range of new ideas on construction techniques, architecutral design, collector economics, and means for utilizing energy to the maximum extent have been incorporated in the new building. An attempt has been made to put the solar heating unit on a commercial basis.

A collector plate made of copper tubing and aluminum sheet, mechanically fastened together, has been employed. This combination uses low-cost aluminum for the large collecting surfaces, and confines the use of copper to water tubing where the corrosion resistance properties of the more expensive metal are necessary.

Except for replacement due to accidental breakage, the cover glass assemblies for the collector should require no maintenance. They are provided with filtered breathing slots to help offset expansion and contraction of entrapped air and other effects due to the thermal stresses set up by the large temperature differences between collector plate and outside air.

Domestic hot water is preheated to the temperature of the storage water by circulating incoming city water through coils in the solar-heated tank.

The living quarters are heated by warm air rather than by radiant panels as were used in earlier houses. The collection efficiency is increased by this method, because water from the air heat exchanger can be returned at lower temperature to the collector.

A large storage tank is used in conjunction with a small (¾ ton) refrigeration compressor. By storing a large quantity of cool water during noncritical periods (cool days, nights) the small unit can intermittently provide much more cooling than would be expected from its rated capacity.

An even more significant feature, in the eyes of some, is the plan to sell the house on the open market after it has been completed. Those concerned with the project hope to recover a substantial part of the cost of the building, less the costs directly attributable to the solar-heating system, of course. Since the house is intended to be more or less competitive with others of similar size, quality, and amenities, some insight will be gained as to the actual costs of constructing a solar house. Buyer reaction to a dwelling of new and unusual design and planned for economy of operation can also be evaluated.

Although the house is located off the campus, the project staff will maintain recording instruments in the dwelling. Their records will yield information on performance of the house as a whole, as well as of the individual components of the system. Such information will enable designers to estimate which components, controls, and complexities are worth including in subsequent systems, by comparing the added cost of a component versus the value of the increased efficiency resulting therefrom.

Members of the Space Heating Subcommittee are: Lawrence B. Anderson, '30, Professor of Architecture; Albert G. H. Dietz, '32, Professor of Building Engineering; Joseph Kaye, '34, Professor of Mechanical Engineering; August L. Hesselschwerdt, '31, Associate Professor of Mechanical Engineering; and Hoyt C. Hottel, '24, Professor of Fuel Engineering. Design work on the house was done by: Austin Whillier, '53, research associate in Mechanical Engineering; Richard W. Hamilton, '50, research associate in Architecture; Robert J. Pelletier, '51, research associate in Civil Engineering; Bernard P. Spring, '51, instructor in Architecture; and N. G. Ashar, research assistant in Chemical Engineering.

Subsequent systems to be built by the project will explore and utilize other techniques for heat collection and storage utilization. To be explored in the future will be methods of air collection, differential black collection surface treatment, surface-treated glass, and refrigeration with solar energy.

M.I.T. Photo

Pioneers in instantaneous photography, as well as Course VI classmates, are Gjon Mili, '27 (left), and Harold E. Edgerton, '27, Professor of Electrical Measurements. They are shown together in the Exhibition Room of the Charles Hayden Memorial Library where a group of Mili photographs were on display during January. Mr. Mili is a leading journalistic photographer whose work has frequently appeared in LIFE *magazine. Two years ago, he spent several weeks at the Institute making a series of photographic studies that appeared in the May, 1956, issue of* LIFE. *Dr. Edgerton has been instrumental in developing high-speed flash and stroboscopic light sources; Mr. Mili has been instrumental in using such light sources in professional photography with considerable success.*

Ground Broken for Athletic Center

■ Early in February the Institute began construction of a new two-story building which will add more than 40,000 square feet to the existing M.I.T. athletic plant and will link several existing facilities into a huge new athletic complex. The new center is being built under a $1,000,000 bequest to M.I.T. by 21-year-old David F. du Pont, '56, an M.I.T. student who was killed in an automobile accident in 1955. It is expected that the David Flett du Pont Athletic Center will be completed early next year.

The building will provide lockers and showers for M.I.T. coeds as well as lockers and associated equipment for 1,200 men students. It will also furnish office space for Athletic Association personnel, coaches, and student managers. There will be other rooms for trainers and training equipment, and a Faculty locker room. The largest single recreational area in the new building will be a 50 x 200-foot space on the second floor which will be divided by rollaway partitions into rooms for fencing, wrestling, and general exercise. Six squash courts will be located at one end of the building.

Being erected on the West Campus (the campus to the west of Massachusetts Avenue), the Du Pont Center will adjoin the south side of the Cambridge

Armory, which M.I.T. acquired last fall for athletic use. The east end of the building will be of Eno brick and the open south side will have a curtain wall of glass and porcelain enamel panels. Main access will be from the West Campus Plaza, site of Kresge Auditorium and the M.I.T. Chapel. A glass-entranced lobby will link the new building not only to the Armory but also to the Briggs Field House and the Rockwell Athletic Cage, providing M.I.T. with an integrated athletic center. The skating rink, track, and playing fields are located nearby.

Architects for the Du Pont Center are Anderson, Beckwith and Haible. The general contractor is the George A. Fuller Company.

Midwinter Meeting

■ Always a high light of M.I.T. alumni activities in the Metropolitan Boston area in early February, the Midwinter Meeting of the Alumni Association this year (on February 4) was most fittingly devoted to topics dealing with the teaching of sciences at the high school level. As in years past, a steak dinner was served cafeteria style, in Walker Memorial, from 5:15 to 7:00 P.M., after which Alumni and guests, including many teachers of science in the secondary schools, gathered at the Kresge Auditorium for a group of four lectures.

Apparatus for something like a dozen laboratory projects was displayed in the corridors of Kresge Auditorium. All were intended to illustrate principles of science, and were designed so that high school students could build the apparatus with a minimum of cost for materials, tools, and equipment. Three water-ripple tanks, to demonstrate wave propagation, interference, reflection, and refraction were adequately explained by young men associated with the Physical Science Study Committee, whose work was described by Jerrold R. Zacharias, M.I.T. Professor of Physics, in the July, 1957, issue of The Review. Homemade telescopes, range finders, optical benches, stroboscopes, microbalances, and a Michelson interferometer were demonstrated – all made of common and readily available components. Other apparatus on display included soap-film apparatus for measuring the thickness of thin films by light interference, and cleverly designed discs floating over a smooth-surface table top with a minimum of friction to demonstrate the principles of inelastic collision. A mechanical model intended to represent an analogue of the refraction of light rays in passing through media of different refractive index was also among the displays.

Promptly at half past seven, D. Reid Weedon, Jr., '41, Vice-president of the Alumni Association, opened the formal part of the meeting by pointing out the need to improve the effectiveness of teaching science in the secondary schools.

Professor Zacharias, chairman of the Physical Science Study Committee, outlined the progress achieved by this committee during the past year and a half. With grants from the Alfred P. Sloan Foundation, Ford Foundation, Fund for the Advancement of Education, and the National Science Foundation, this committee has assembled a working group of several score of scientists and teachers in colleges, universities, and the high schools, and has set itself the task of providing a new and stimulating curriculum in physics.

The object of this new program (which is on an experimental basis for the present) is to stimulate interest and enthusiasm for the teaching of physics at the high school level. To this end, new textbooks have been written, much laboratory apparatus (all inexpensive and as simple as possible) is being built, instruction manuals are being prepared, motion picture films are being made to illustrate principles of physics that may be difficult, expensive, or inconvenient to demonstrate, especially in the smaller or less well-equipped secondary schools, and supplementary texts are in preparation. Recognizing that not everything in physics can be taught at the high school level, the committee has selected for emphasis those topics that seem to be most fundamental in illustrating principles of physics, and leaves to supplementary reading, on the part of the more advanced and interested students, further study regarding applications of these principles. The new course is intended to provide adequate instruction for those who do not advance any further in their physics work than the high school level; at the same time, it should provide a firm foundation even for those whose ultimate purpose is to become professional scientists or engineers.

Illustrating an example of the kind of motion picture film that will be made available, Dr. Zacharias showed a sound film in color demonstrating the pressure produced by light. This film showed that the ordinary vane radiometer, as obtainable at optical stores, does not operate by light pressure, although this effect is sometimes erroneously ascribed to the blackened and silvered whirling vanes when the radiometer is placed in a beam of light. The radiometer is not only too insensitive to show the effect of light pressure, but the effects cannot be properly explained, for the vanes rotate in the wrong direction to be attributable to light pressure. It has been shown that the rotation of the vanes is associated with the heating and gas pressure in the radiometer. A simple apparatus of high sensitivity, in which a very thin vane of aluminum is supported from a fine quartz wire in a highly evacuated tube, can be made to show the effects of light pressure, if advantage is taken of the natural period of oscillation of the vane as it is rotated on its fine torsional suspension.

Elbert P. Little, Executive Director of the Physical Science Study Committee, who has taught physics at secondary schools as well as at colleges and has a broad scientific background, explained the work of the Physical Science Study Committee. This committee is now involved in the writing of a new exciting textbook, designed to make high school physics a real adventure; and it is designing laboratory and demonstration apparatus that is spectacular, timely, inexpensive enough for the smallest school, and easy to assemble and store. In addition, almost 100 paperback books are in preparation, covering a broad range of supplemental subjects to provide low-cost, authoritative, and stimulating outside reading on the part of the interested and advanced secondary school student.

(*Continued on page 272*)

Answers to Sputnik?

Federally sponsored university research centers, operating on a truly interdepartmental level, are proposed to meet current national defense needs

by ARTHUR R. von HIPPEL

The little satellite circles like an embarrassing fly over the heads of the free world. "Spray it with DDT," says the man in the street. "It violates our air space," says the diplomat. "This requires an agonizing reappraisal," says the administrator. Committees are called to shift the blame; and reassured by the clanging of crash programs, declassified reports and more meetings, the country will settle back to sleep unless we all feel responsible that liberty shall not be lost.

But how can one expect heroic deeds, especially in times of high prosperity, if the true issues are not clarified? And who can speak with real competence? We all see only fractions of the picture. Still, if each one of us inserts his part, we will create a picture of the whole.

The writer's work is concerned with modern materials research. In this area, of vital importance to national defense, a revolution has taken place in thinking and research approaches. The administration patterns of American universities and government services dealing with this field have become as antiquated as Model T Fords. The Russians, not stifled by tradition of the past, are bound to build the institutes our modern times demand.

This crisis is not solved by spending more money and simply expediting. Ours is a really obsolete machine; and billions are misspent and years are lost in tries to keep it running. But let us explain, step by step, the situation now existing and the solutions that might provide an answer.

Modern Materials Research

The technical competence of a country is reflected in the way it uses and converts nature's resources. Until recently the approach has been an empirical one: materials were found, their macroscopic properties evaluated, their chemical constituents analyzed, and applications made after proper shaping and processing. Test procedures, based on practical experience, were the exclusive guide of the engineer.

Suddenly, all this is changing. Fundamental science – in decades of quiet studies on electronics, atoms, molecules, and their concerted action in gases, liquids and solids – has reached the stage where a more powerful approach becomes possible: "Molecular Engineering," the building of materials to order.

This means that we need not take the metals and plastics, the rubbers and electronic components that industry mass-produces for buildings and household appliances, cars and radios, to construct with them our space ships and missiles, nuclear power plants, computers, and the other devices on which our national safety critically depends. We can design materials with prescribed properties for the purpose in hand. We can understand, by observing the molecular phenomena, why materials fail; we can build into the materials the remedies against such failure and get true yardsticks for ultimate performance in the various situations encountered. We can dream up completely new devices, not shackled any more by presently available materials and empirical performance characteristics.

This development spells the end of the specialization of the past, where scientists and engineers of the various professions were walled up from each other in air-tight subdivisions of schools and departments. The time of synthesis of specialized knowledge has arrived, in which we begin to think about materials and their applications in unified vision. The fundamental concepts which help develop high-temperature materials for missiles, better semiconductors for transistors, or new antibiotics for medicine are the same – the designing of molecular structures with prescribed properties. A true "One World" draws into close alliance all sciences and all engineering, and the promise of this Molecular → Science / → Engineering approach is tremendous.

In quiet times we could sit back and let this new insight seep through the minds of our people in the span of a generation. Unfortunately, today's new technological concepts are weapons. When used only by the opponent, they spell disaster as surely as the phalanx of Alexander the Great doomed the Persians or the advent of firearms broke the power of the knights of the Middle Ages.

Materials and Defense

Our industry is geared to mass production; it earns its money with the goods our daily life demands. Its products today are not basically different from those used before World War II; and our armament at that period required about the same materials as the civilian economy.

That this was actually a misconception became rudely clear in World War II. Suddenly we had to fight in all climates of the globe, and the failure of materials brought our campaign to a standstill in the South Pacific. The gear was eaten by mites and fungi

and rotted in the moist heat of the jungle. Science and technology soon provided resistant materials, but many agonizing months were lost before the supply services responded to the needs of the fighting men. Inertia in continuing the use of materials and devices, even if they prove self-defeating, is an exasperating Newton's law of economics.

It proved easier to provide needed materials for new weapons like radar, for which no established supply sources existed, but here a different lesson had to be learned. The first available dielectric, capable of insulating and guiding radar waves, was polystyrene: styrene was already in mass production for the manufacture of synthetic rubber. No one cares for purity of rubber tires, but extremely small amounts of impurities may disqualify a radar dielectric by causing absorption of the microwaves. The commercially produced polystyrene hence proved completely unsuitable for radar purposes. Only close co-operation between science and industry under the pressure of war succeeded in providing methods in time to measure and improve the matériel and bring it into production in special plants.

This instance illustrates by implication the crucial difficulty of combining in peacetime a strong national defense with the profit motive of free enterprise. Items of the civilian market are the money-makers and were good enough for the defense of the past. Today's defense technology has moved out of the sphere of normal life into the realm of unheard-of speeds, temperatures, and pressures. Our decisive weapons now are not mass-production items on which industry can make a profit. They are ultimate weapons, few in number, which should be built with extreme precision from the right materials and components. Properly designed materials and really reliable components are not available today, industry has neither the experience nor the inherent urge to produce them; and there, for now, we are stranded.

Radar and radio astronomy installations, such as this radio-telescope antenna of the Stanford Research Institute at College, Alaska, are prime examples of the modern need for materials of high purity and exacting, made-to-order properties.
Elliott B. Roberts, '21

To be more specific: Prevention of war today is unfortunately not yet based on human insight and mutual understanding but on the existence of an unbeatable deterrent. A few hydrogen bombs can devastate a country; a few dozen of such bombs, placed as war heads into missiles which can be delivered with certainty, will hold the world in check. Our ultimate defense strength thus relies on extremely small numbers. Why do our missiles misfire so often? Why do we want our missiles mass-produced? Is it because we buy conventional material and components from industry as a householder buys glass and screws from a hardware store? Is it because we think in terms of artillery bombardments of World War II? To prevent the next war, we have not to buy quantity but quality and extreme reliability, and that we can have only through modern materials research.

Federal Research Centers at Universities

The country needs more scientists and engineers of excellent training; only universities can train them but their financial means are insufficient for the task. The country needs modern materials research for defense; beautiful research is being done in a number of laboratories of industry but only universities can provide the atmosphere of pioneering research where knowledge is sought for knowledge's sake without bias and industrial ties. The universities should create broad interdepartmental laboratories where scientists and engineers work as true allies; they have not yet found the framework to do this. The Armed Services need centers of information in which the latest knowledge for a whole research area is available and facts can be checked unbiased; these have not been created. The Armed Services have pioneering divisions in their research laboratories, which are supposed to work free from immediate tasks for long-range planning; several of such installations, favored by location and understanding administration, have enviable records, but in general, such laboratories do not flourish, because the atmosphere of free inquiry cannot be created; they have been depleted of men by industry and are frequently not more than storage rooms for beautiful equipment. The research scientists and engineers of the Armed Services in locations removed from universities are bound to grow stale, just as medical doctors would, if no refresher periods in universities were provided. All these needs can be met if we have enough imagination for a new venture of co-operation between government and universities.

We need federally sponsored research centers at the universities which combine the highest standards

(*Continued on page 268*)

The Dignity of the Individual
IN THE TWENTIETH CENTURY

The most meaningful province of private enterprise is universal moral discipline. We must now demonstrate that members of a free society can — and will — give their devotion to the common good.

by JOHN B. WILBUR

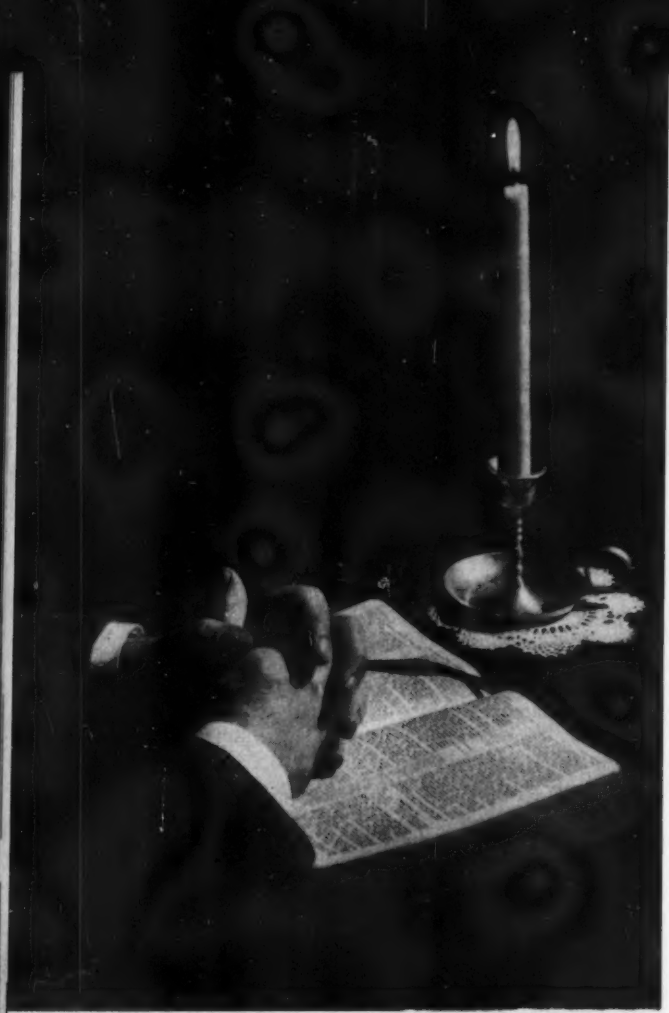
I HAVE been among those who have shared a concern for the effect of technological progress on the dignity of the individual. Among the advances of technology, I include everything from guided missiles to blenders, sports cars, and picture windows. By dignity, I mean not only the intrinsic worth of man, but a certain amount of self-determination into the bargain. By the individual, I refer to you, or to myself, or to any person who, in this Twentieth Century, may seem to have a lesser control over his own destiny than we like to regard as man's birthright.

That the march of technology is currently something of a mixed blessing has been pretty well assimilated into the American consciousness. It is not, of course, that we aren't pleased with all that our shiny new hardware has done to better our living, or even that we aren't eager for bigger and chromier gadgets. But today it is difficult to avoid the realization that what began as the control of nature to make our lives a little happier and a little more secure, has so mushroomed that it has released forces and tendencies that could harm or even destroy the very civilization that has been reared to expect improvement.

While we may manage to forget it much of the time, the spectre of catastrophe lurks over us – and it frightens us, not only because it would be such an horrendous thing, but because we feel so individually impotent either to prevent it or to protect ourselves if it should come to pass. And we need not go to extremes to sense technology's impact on our self-assurance: there is the electronic brain, which some fear as a challenge to mental integrity; and there is automation, which to others is a threat to the dignity of labor. Closer to most of us, there is the extent to which we have become dependent on oil, for example – or on electricity; and there is our constant dependency on a host of other people that has come from technology's offspring – the division of labor. It is sobering to dwell on possible implications of this enveloping interdependency of people and technology; and it is not surprising if we sometimes feel that we have been more successful in terms of technological advance itself, than in the meaningful integration of technology into our culture.

To be fair, technology has – in many ways – enhanced the status of the individual. It may well be that nuclear energy will, in the end, prove itself a benefit to civilization. So-called electronic brains are not gargantuan monsters – they are but glorified adding machines; by taking over the drudgery of massive computation, they can free and support man's mental energies for his more creative efforts. Automation will not replace man save on repetitive assignments; being more sophisticated than mere mechanization, it can lessen not only the muscular burdens of greater productivity, but the more tedious aspects of its mental demands as well. And if the increasing dependency of man on technology has lessened his stature as a separate being, it has surely brought him much that can enrich his life, and leisure for the enrichment. These points can be argued, and there is truth in them; yet despite their truth we live in an anxious age when more could happen to us in less time – and through forces seemingly beyond our control – than has ever before been possible. Man-made perils have become ascendant over the perils of nature, and man seems an unreliable custodian of the power to destroy. In a very real sense, the sky might open up

Photograph by H. Armstrong Roberts



Photograph by Harold M. Lambert
An old teaching can assume fresh importance in a time when man's technical genius has developed too rapidly to maintain a close liaison with his moral behavior.

above us in a twinkling; and this may seem a treacherous shelter indeed for the nurturing of dignity.

Reassuringly, the shelter is not so vulnerable if we look to man's intrinsic worth – for his inner values need not cower behind bulwarks of mortar and of steel. Forces beyond his control may blast the structure of his physical welfare; but if man so determines, there are no forces that can arrest the seeking of his moral and spiritual potential. Blenders, sports cars, and picture windows are all very well in their place – but they are not the bread of life. Living to a ripe old age, secured by a pension, may prove a blessing if it comes – but it is scarcely the purpose of living. Most of us would agree that the inner worth of man is more likely to be measured by the rewards he deserves than by those he receives, and more often reflected by the devotion of his service than by the years of his existence. There seems good reason to believe that in the Twentieth Century – or in any century – intrinsic worth can be inviolate.

I can accept the idea that technological advance involves no built-in barrier to the intrinsic worth of the individual; but I cannot drop it there, for I find it difficult to divorce dignity from a certain degree of self-determination. We cannot camouflage the fact that technological progress has brought us to a time when – regardless of who is ahead in the race for destructive power – men in distant places could, in an hour of terror, issue orders that might lead to the obliteration of much of the world as we know it. In this dilemma it is not easy to see what the individual can do to minimize the hazards that face him. When we sense a lessening in the influence of our actions on our futures – when we feel that there is a threat to the role of self-determination in our strivings – then our dignity as individuals seems to find itself in jeopardy.

Most of us would agree, however, that universal moral discipline could insure the co-existence of men with the two-faced prodigies they are creating. A few may hold that widespread discipline is best achieved in a pattern planned around the state's requirements, and put into action by a centralized authority. This may appear the best way to security; but how often would state-ordered discipline, based on the dictates of one man or of a group of men, be guided by motives that were moral in their nature? And if the surrender of free choice were the price-tag of security, would not dignity itself be forfeited into the bargain?

Universal moral discipline can, it would seem, rest only on the voluntary self-discipline of the individual. It can germinate in no other manner; it can be encouraged by precept and example, but it cannot be forced upon us; it is the private obligation of the individual – indeed, it is the most meaningful province of private enterprise. It may be that in dedication to high purpose, even of a fairly small group of people, there is a whole that transcends the arithmetic sum – paving the way, perhaps, to a more general moral emergence – and leading, at last, to a more mature status for all of mankind. Whether this be an old or a new hope seems quite beside the point; an old teaching can assume fresh importance in a time when man's technical genius has developed too rapidly to maintain a close liaison with his moral behavior.

If there is a deterrent to active acceptance of this doctrine, it springs, perhaps, from the thought that – fine words to the contrary – however well we order our own behavior, there is small likelihood, much less a guarantee, that others will be so moved. Yet, is not venture for high purpose, lacking the while the certainty of success, the very essence of true dignity? If there is a promise in spending one's self freely in pursuit of an ideal, it lies in neither victory nor defeat, but in the tasting of the flavor of living along the way.

Technology, in crossing the boundary of insured control, has swept us into an era of new dimensions. We must now demonstrate that the members of a free society can and will – voluntarily and without guarantee of security – give devotion to the common good through the mature conduct of their day-by-day living – a devotion more selfless and more consistent than can be exacted by the rule of any dictator, or under the compulsion of statism in any of its various forms. In this Twentieth Century – when we may determine whether the products of technology are to be gainfully used or frightfully abused – there is not only room but, indeed, the greatest possible need, for the dignity of the individual. Technology is part of civilization, and we must learn to live with it.

From Test Tube to Table

Many products common to the American dining table 10 years from now will have achieved acceptability because of research now going on in food technology

by S. A. GOLDBLITH and B. E. PROCTOR

THE era of the chemist or technologist in his small dingy laboratory or off to one side under the stairs has completely passed. Today, food scientists and technologists are taking their places in important management positions in the many areas of the food industry, which is our nation's greatest single endeavor.

This has come about because of greater awareness on the part of management of the increasingly important role the research of today plays in the company profits of tomorrow. Many doctoral students in the Institute's Department of Food Technology take a minor in industrial management. Thus, we have emerging today a new type of food technologist, one who is aware of more than the test tube – one who is cognizant of the fact that products must be sold not just the first time – one who knows the meaning of the term "repeat sales."

The modern food technologist is a man well trained in the disciplines of mathematics, physics, chemistry, biology, and the relationship of these basic disciplines to foods, and able to express these through an engineering operation.

Recently, the research director of one of our large supermarket chains was questioned about his concept of what the future planning of the supermarket chains should be – for the year 1980 or 1990 – based on today's technological progress. At the time we were surprised at his reply to the effect that his organization was interested now, and planning now for the year 1960 or 1965 and that this was quite a difficult task in itself. They really were unable to go as far ahead as 1980 or 1990 in their planning because things are moving so rapidly.

If one analyzes this particular business, the type of equipment, and the facilities needed for the initial capital investment for supermarket business, one can understand the enormity of the problem for immediate planning for five years or 10 years from now.

On the other hand, one should realize that the progress of technological research is usually relatively slow. The time required from the concept of an idea or of a new food product or of a new means of processing which will bring a new food product to commercialization may be relatively long. Most developments in food processing have not occurred overnight. For example, Nicholas Appert invented "canning" 150 years ago; mechanical refrigeration equipment was developed about 1850, but the commercial utilization of freezing for food preservation did not really begin until about 1930. Thus, perhaps more long-range planning may be needed after all.

There are many problems which must be solved between the concept of a new idea, or new food product, and its successful launching on the market. What are the major technical problems to be solved before a new product can be put on the market and become a profit maker? In general, it has been pointed out[1*] that any new food product must possess the following characteristics in order to be advantageous from the point of view of the company developing it: (1) Convenience; (2) Acceptability; (3) Nutrition; (4) Economy and efficiency; and (5) Safety.

Any new food product possessing these five basic factors must also have other characteristics to be successful. It must (a) be superior to any competitive products which are now available on the market; (b) offer something additional to the products available today; or (c) be a completely new product possessing great sales appeal, preferably by convenience.

The five characteristics of a new product listed above actually are abbreviated, since they include a whole host of factors which are encountered and must be solved in new product development. What are some of these included factors?

(1) *Convenience.* As the term is used here, convenience alludes to today's trend in the housewife's desire for more time to do other things. Convenience foods represent the impact of Mrs. America on the food industry.[2] Convenience means processing. (In 1956 some 71 billion dollars were spent for foods in this country, of which 50 billion dollars went for convenience items – processed foods!) Strictly speaking it means moving kitchen operations into the food factory!

Thus, in the development of a particular new product today, some processing technique will have to be considered and worked on. In the case of dehydration, for example, will the product be dehydrated by means of a spray drying, drum drying, or lyophilization (freeze drying).

Convenience also calls for proper packaging of the product. If the package is not easily opened, the product will not meet with favor. And let us not forget the primary mission of the package – protection of the food. Many housewives today have never seen the cracker barrel of the general store era.

[1*]Please see numbered references at end of article, page 266.

(2) *Acceptability.* Will the product be more acceptable, more palatable, and more desirable to the consumer than competitive products or products in a similar class? Acceptance of a product requires expert organoleptic panel evaluation and screening of the product during the developmental stage, statistical evaluation of these many data, and finally consumer acceptance testing for the ultimate test.

Acceptability also means packaging from a different point of view – the attractiveness of the package – "sales appeal." Eye appeal sells more than 50 per cent of the products in today's supermarket.

(3) *Nutrition.* Many people are unqualified to judge nutritional quality either in a single product or in a diet – but every consumer is in favor of good nutrition. It has a plus value, although few housewives will read the labels on a package to see if a product is optimum. Very rarely will an average consumer pay a premium for good nutrition but will reject questionable products on a faddist's advice.

(4) *Economy.* A new food product must be manufactured as cheaply as possible in order to compete. It must be as economical as possible and still produce the desired convenience factors. One can readily guess that there is a maximum amount that a housewife will pay for a certain degree of convenience. By going beyond that particular degree of convenience we encounter the old story of the law of diminishing returns. Low cost of a product to the consumer must often be aided by increasing the efficiency of factory production methods with the use of new and higher speed equipment, either in processing or packaging. Both of these fields are making tremendous strides in today's food manufacturing plants.

(5) *Safety.* A food must be safe to eat as well as nutritious. Thus, processing times which insure safety of the product, as well as optimal process times in terms of the best flavored product, must be obtained. The safety and wholesomeness of the product must be assured. Assurance in safety is considered present because of the care and diligence exercised by the U. S. Food and Drug Administration in its activities to protect all food consumers.

One can readily see that the development of a new food product, in terms of the five basic factors listed above, takes time, people, and equipment, all of which integrate into expense.

What are the factors that have an influence on the new food products appearing on the market today? Many of us are familiar with the article in *Fortune* in 1953[3] and the more recent article in *Food Processing.*[4] Both articles illustrate very succinctly the market of convenience, the increase in life expectancy, the increase in population, the increase in earnings, and thus the reflected increase in living standards and how all of these have had an effect on the thousands of neat little packages surrounding us on a visit to any modern supermarket.

There is another way of looking at this subject, however, and that is from the analogy of two small rivers having their origin in two separate mountain belts and both flowing into a common larger river which empties into the ocean. One of the rivers represents production knowledge of today which has been obtained by the fundamental research of yesterday. The other river represents consumer demands, arising basically from more income from more people. Together they are integrated in the modern food industry of today resulting in what we now can see on a visit to any modern supermarket.

Packaging and Its Influence on Today's Foods

Packaging plays one of the most important roles in the modern supermarket.[5] A glance into the recent past may make this even more vivid.

A century ago – even a half century ago – when a housewife went shopping, the grocer dug out raisins from a battered fly-bitten box, kicked a tomcat out of an open barrel of cereal or of sugar, sliced a ham with a general purpose utility knife that cut everything, and laid the slices of meat on some old pieces of secondhand paper.

Contrast this with today's packaging. Plastic films, metal foils, laminates, flexible and rigid materials provide packages with bright attractive lithography. We have glass containers and metal ones, and food packaged in tubes. Packaging has opened up a whole new era in foods.

Today's Newest Products

Among the products which have been associated with the market of convenience and which have had a tremendous influence on the shelves of grocery stores within the past five years have been the following items: prepared cake mixes, precooked frozen fish sticks, instant milk, frozen dinners, prepackaged fresh meats, frozen meats, soluble nonfat milk, and dehydrates.

Baking mixes have had a tremendous impact on the American housewife, as well as on the industries which are contiguous to the cereal industry – the shortening industry, the spice industry, the flavoring industry, and the dairy industry.

While the idea of mixes dates back to 1889 with the familiar "Aunt Jemima" pancake mix, it is only within recent years (with the development of new ingredients and processes, such as antioxidants, tailor-made shortenings, de-sugared egg solids, active dry yeasts, and locked-in flavors) that it has been possible to obtain many varieties of baking mixes which have good shelf life and which compare favorably both in finished product and in cost with the old-fashioned homemade product. In 1955 it was estimated that $137,000,000 was spent by Mrs. America on 350,000,000 packages of baking mixes!

Precooked frozen foods are another important item in the convenience market. The reason for this, of course, is the desire for Mrs. America to have more time for communal affairs and for more leisure time.

In general, the frozen food market represents an accomplishment on the part of food technologists to obtain foods with the same savory characteristics throughout the year that are normally associated with fresh foods in season.

The development of home freezers from the unknown to the commonplace since World War II, as well as the development of excellent display cases for stores, has helped increase the sale of frozen foods. Frozen foods accounted for some 3.8 of the 17 billion dollars' worth of chain food store business

J. H. Thomas

in 1954, and it is estimated that, in 1960, frozen foods may account for 10 per cent of the chain supermarket sales.[6] This is an enviable record for an industry which has just celebrated its 25th birthday.

Of all the frozen foods in 1955, prepared or precooked foods took first prize in terms of increase in sales. Pot pies outrank all others in dollar sales except orange juice, and the list is ever expanding, as potato products, fish sticks, complete dinners, waffles, fruit pies, cheesecake, cream pies, Chinese foods, pizza pies, and blintzes are added.

Precooked frozen foods represent one of the outstanding examples of laboratory achievement being translated into commercial production. The problems to be solved were manifold and covered almost every aspect of food technology from the basic raw materials to the package, and from processing techniques to distribution.

Instant milk represents one outstanding development, both from the point of view of new process techniques as well as from the standpoint of dairy products themselves.

In so far as milk is concerned, one of the revolutions of the Twentieth Century has been the development of "instant" nonfat skim milk solids. This development has catapulted the use of dry skim milk solids from the unknown to the commonplace in the home, as well as in bakeries and other food industries. Not only have a number of companies begun producing this milk, but also types of equipment for its manufacture have been developed.

Prepackaged frozen meats have been another item which has had a recent boom, again due to the desire of the housewife for convenience foods. Prepackaged frozen meats have been popular from the point of view of the housewife for she knows exactly what she is getting and that there will be little or no waste. Furthermore, with the development in packaging that has taken place over the past few years, it has been possible to have all cuts and types of meats of the highest quality readily available.

Dehydrates represent the ultimate in convenience items. They range all the way from powdered beverages, cake mixes, dessert mixes, soup mixes, salad dressings, gravies, and sauces, to milk drinks for infants. While dehydration dates back to antiquity, it is only since the tremendous requirements for feeding our troops overseas in World War II that the dehydrates have come into their own.

Advances in technology have made possible the multitudinous varieties of dehydrated foods of superb quality that we have today. Dehydrates may be considered a war baby for, if one were to study the history of warfare, one would find that in the Civil War and in the Boer War troop rations contained dehydrated foods.

World War I saw the industry expanding to a marked degree. However, the fundamental knowl-

edge and technology of dehydrates were so poor that the industry suffered a decline following World War I. World War II, however, saw an immense amount of research carried on by the Department of the Army, as well as industry, with the result that following World War II there has been a tremendous upswing in consumer acceptability, as well as resultant sales. The soluble coffee industry itself now accounts for over $200,000,000 in annual sales, and this industry did not really become popular until after World War II and technological developments of that time.

One has but to look around in any supermarket and become amazed at the number of dehydrates that have assumed a large amount of shelf space because of consumer demand.

If one were to look at the various rations available for the Armed Services today,[7] one cannot help being impressed with the tremendous amount of research and development that have gone into the preparation. With our Armed Forces numbering in the vicinity of 2,000,000-3,000,000 men, widely scattered over the four corners of the earth and in locales varying from many leagues under the sea to 10 miles in the air, one cannot help being impressed with the tremendous accomplishments of science and technology in overcoming the feeding problems. Every one of today's newest products is a part of the food for the Armed Forces plus a few others, such as Air Force in-flight-meals, liquid meals and semisolid meals, and many others.

The story is now old about the nuclear submarine and the need for surfacing only for re-enlistment purposes of its crew; but this does give us an idea of the problems with which the military and the food industry are faced regarding special feeding problems for the submarines in the nuclear age.

Foods have been developed, and more foods must be developed, which will require a minimum of space, a minimum of refrigeration, and offer a maximum of nourishment and a maximum of consumer acceptability.

New Foods and New Food Processes

When speaking of this subject, one really becomes a prophet, but prophesying for the food industry is really not so difficult as for some other industries, because it is a fairly safe wager that in the year 1975 or in the year 2000 our descendants will like steak as much as we do today. Moreover, it is a pretty safe prediction that in the year 1975 or in the year 2000, 99 out of 100 persons will want to eat three square meals a day.

Today, we see the development of a number of food items, a number of food processes, which are on the horizon for tomorrow. It is difficult to separate food items and food processes because new food processes will result, undoubtedly, in new food items. Let us look at processes for the moment.

Today, we are in the atomic age, and food technologists are now just as aware of this as are nuclear physicists. Some 14 years ago, the M.I.T. Department of Food Technology pioneered in the use of ionizing radiation energy for the sterilization of foods, drugs, and pharmaceuticals. Today, the atomic age is producing disease-resistant grains, and tomorrow, when the problems are solved, pasteurized and sterilized food products should be available on the open market.

Today, radiation-preserved drugs are available for purchase. There is no reason to doubt that a number of the problems now being worked on in the field of radiation preservation of food will be solved some 10 years hence.

The biggest single problem facing radiation preservation of foods is associated with the changes which take place in the foods due to radiation and which are undesirable from the point of view of consumer acceptability. Some of these problems have already been overcome. Others are being worked on in many laboratories throughout the country. Five years ago almost every food technologist in the country would have said there is no hope of overcoming the problems involved in making milk a successful radiation-sterilized food. Milk is one of the most sensitive of foods when treated by ionizing energy. Radiation research in the laboratories of the Department of Food Technology at M.I.T. has resulted in a new method of using ionizing energy for the sterilization of milk, which has already enabled us to bring the off-flavor threshold recognition dose of radiation for milk and milk products within range of the sterilization dose, and certainly far beyond the range of dose required for pasteurization.

Because of the tremendous impacts and large sums of money now being spent in research in this promising field of food technology, I think it is safe to say that within the next decade a radically new method of food processing will be available and will be in limited use throughout the country.

Radiation preservation will not supplant refrigeration. This is one of the misconceptions that many people have about cold sterilization. You may recall that 30 years ago, it was prophesied that freezing of foods would replace canning. Yet in 1955 more metal containers and glass jars for heat-processed foods were manufactured than in any year since canning started. In this same period, freezing of foods has increased rapidly. This increase has apparently been without any effect on many canned products. The per capita of consumption has increased from 30 pounds per capita to 96.7 pounds per capita in the past 25 years. Thus, new food processes merely mean more processed foods of many kinds rather than less food processed in one particular way.[8]

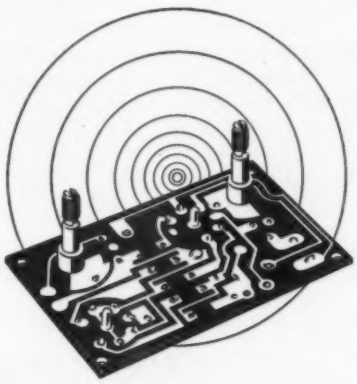
The analogy between the freezing and the canning industry of the past 25 years is just as applicable today when one compares radiation preservation and refrigeration. Radiation preservation will only supplement and complement refrigeration rather than supplant it. Based on the technological knowledge of today, and the research work already done in our Department on radiation, we can foresee the time when preserved chopped meats (hamburgers) can be kept well over a year by mild radiation treatment, whereas without such radiation, they normally keep only six or seven days at most at temperatures of 40 to 45 degrees F. Other food products which may

(*Continued on page 260*)

BUSINESS IN MOTION

To our Colleagues in American Business . . .

"Printed circuits!" "Printed circuits!" You hear it on all sides today. And well you might. For printed circuits have so many advantages. They have compactness as compared to conventional wiring and compactness that makes possible better assembly arrangements and techniques. Numerous, time-consuming hand operations are eliminated, there are fewer rejects, shorter, less intricate assembly lines, and fewer soldering operations, as with printed circuits a single dip-soldering operation can solder all joints at once.



Revere, naturally, has been interested in printed circuits from their very inception. So Revere Research Engineers immediately went to work to perfect a copper that would meet all of the rigid requirements encountered in manufacturing printed circuits as well as those necessary to their efficient operation. Accordingly, they set up these rigid specification standards: there can be no peaks or valleys. Surface must be hard and of uniform density through and through and side to side to maintain positive conductivity throughout the circuit. Also, a hard surface permits resist to clean off easily as there are no pores to hold resist and cause trouble later when soldering. Even the most closely spaced and finest lines encountered in a printed circuit must have a sharp definition of the edges and be freer from pits, pinholes and imperfections.

Also, the copper must be free from oxidation as it comes from the mill and without lead inclusions, present a sufficiently clean surface so that fluxes will wet readily and when automatically soldered the solder coat will be uniform every time . . . free of skips or bald spots. Copper-to-laminate bond strength must be uniform and adequate. Revere Rolled Copper also shall exceed standard specifications as well as meet ASTM B5 specification for purity with a 99.9% minimum rating.

Those were the rigid standards set up by Revere Research Engineers and those are the standards met by the Revere Rolled Copper now available in unlimited quantities. Said one laminator, after using Revere Rolled Copper, "It enables us to give our customers superior copper-clad laminates that present a smoother surface (freer from pits, pinholes, and imperfections) . . . more uniform thickness without sacrifice of conductivity. The result has been, consistently satisfactory etching at better production rates."

And, because you can get all the advantages of Revere Rolled Copper at no extra cost it will pay you to make absolutely certain that you specify Revere Rolled Copper for your printed circuits when you order your boards from your laminator.

But, whether you order Rolled Copper from Revere or other materials furnished you by other manufacturers . . . the best results and the greatest satisfaction are obtained only when you take your suppliers into your confidence.

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TEST TUBE TO TABLE

(*Continued from page 258*)

have their refrigeration shelf life extended are luncheon meats, frankfurts, and other cuts of fresh meats, such as steak.

Another new method of food processing includes the application of antibiotics to increase the shelf life of foods. Today in the United States chickens are being processed in ice containing antibiotics in order to extend the shelf life of the chicken. Research has indicated the tremendous possibility for other antibiotic-processed foods. The rationale of this method is that the antibiotics will inhibit the microorganisms which grow, multiply, and cause spoilage. Thus, increased shelf life is obtained. The Food and Drug Administration allows this process with chicken because chicken is never eaten in the raw form but is cooked thoroughly, and it has been found that the amount of cooking required will destroy any antibiotic. The Food and Drug Administration has thus far not allowed the antibiotic to be used with any other food in this country although Canada has allowed certain antibiotics to be used with fish.

Research is under way now with other antibiotics in various types of fish and with injecting antibiotics into meat animals just prior to slaughter. Antibiotic-treated foods may be one of the developments to be looked for in the grocery market of the future.

A third method of processing which may find its way into food products will be the application of microwave energy for processing as well as for cooking. You all know that ranges are now being manufactured which have radar magnetrons as energy sources to permit uniform and rapid heating throughout products so that roasts may be prepared in 25 minutes and cakes baked in one minute. These electronic ovens are available today. The basic principle, that is, high-frequency heating, may find its way into food processing of tomorrow for the production of certain dehydrated foods.

One of the developments of today still in the research stage is frozen baked goods. The most modern bakeries of today preparing for a large supermarket business find it necessary to change formulae and ingredients a number of times each day. Thus, the production capacity is greatly reduced due to the necessity of changes to meet the large variety of products which must be baked. Sometimes production is changed as much as 40 times in one day in one large bakery. If one were able to spend a certain period of the week producing only one item, such as bread, and then freeze the bread properly so that it could be shipped in the frozen state and kept in warehouses until required, one could raise the production capacity of a particular bakery severalfold and thus more than pay for the increased cost due to refrigeration.

Frozen baked goods are being developed today which do not differ in quality from fresh baked goods and with a resultant saving to the producer, not only in dollars but in production facilities. Tomorrow – and this tomorrow is almost here today – I think one

(*Continued on page 262*)

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#20 Gauge	.110″	.60	.50	.45	.40
#20 Gauge Shielded	.135″	.65	.55	.50	.45
#16 Gauge	.135″	.70	.60	.55	.50
#16 Gauge Shielded	.160″	.80	.70	.65	.60

SUPER-JET POWER CABLE

#20 Gauge	.150″	.80	.70	.65	.60
#20 Gauge Shielded	.175″	.90	.80	.75	.70
#16 Gauge	.160″	1.00	.90	.85	.80
#16 Gauge Shielded	.185″	1.10	1.00	.95	.90
#12 Gauge	.200″	1.20	1.10	1.05	1.00
#12 Gauge Shielded	.225″	1.30	1.20	1.15	1.10

This important development is now available.

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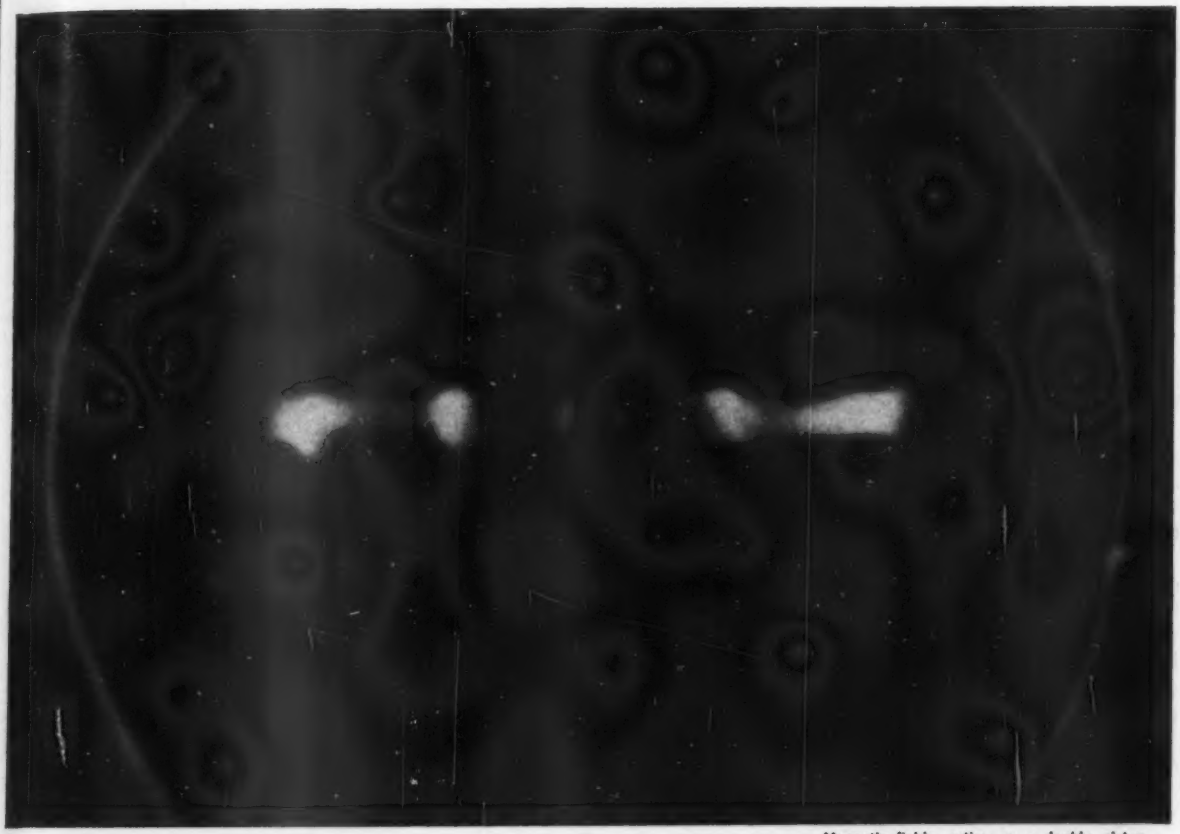

Magnetic fields, acting as a double piston, drive luminous ionized shock waves through transparent tube. One-tenth microsecond exposure in STL's Physical Research Laboratory.

MAGNETOHYDRODYNAMICS and SPACE TECHNOLOGY

Magnetohydrodynamics provides one of the most promising approaches for attaining the velocities and specific impulses that will be required for manned space flight to a planet, landing, and returning.

The critical problem in attaining velocities of hundreds of thousands of miles per hour is the containment of temperatures comparable to those in the interior of stars. Because the temperature of the driving reaction will have to rise as the square of the exhaust velocity, temperatures greater than one million degrees will be encountered in reaction chambers. Magnetohydrodynamics offers a unique solution to the basic problem of containing the reaction without contact with the chamber walls.

Briefly, the physical principles of magnetohydrodynamics are these. Since gas at such temperatures is completely ionized and is an effective conductor of electricity, the introduction of currents in the gas (in this state called a plasma) creates an electromagnetic field. This field makes it possible to control the plasma by applying an external opposing magnetic field which creates a magnetic bottle to contain the charged gas particles. Similarly, a magnetic-field piston can be used to accelerate the particles. Such magnetohydrodynamic reactions are expected to develop exhaust velocities that are an order of magnitude greater than those generated by present chemical rockets.

At Space Technology Laboratories, both analytical and laboratory work are proceeding in the field of magnetohydrodynamics. This work illustrates the advanced research in STL's Physical Research Laboratory, which emphasizes the application of basic physical principles to the requirements of space technology.

In support of its over-all systems engineering responsibility for the Air Force Ballistic Missile programs, and in anticipation of future system requirements, STL is engaged in a wide variety of research and experimental development activity. Projects are in progress in electronics, aerodynamics, propulsion, and structures.

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SPACE TECHNOLOGY LABORATORIES

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TEST TUBE TO TABLE

(*Continued from page 260*)

will see a large number of baked goods on the market distributed in the frozen state. Thus, a given bakery might bake bread on Monday and Tuesday and then bake pies on Wednesday. These items will be frozen and distributed as needed for the rest of the week or even for several weeks. Then Thursday and Friday will be used for the production of various other miscellaneous products, such as buns and cakes, with a resultant increase in the plant's output.

Another product to come on the market tomorrow will be dehydrated meats. Thus the housewife of tomorrow will be able to go to the grocery store and buy five one-pound steaks weighing only one pound and keep them on the pantry shelf instead of in the refrigerator. When she is ready to use them, all she has to do is soak them in a predetermined amount of water for a predetermined amount of time and put them in the oven to broil.

Another development which is in the test-tube stage today, but which certainly should be available tomorrow, are the aerosol foods. Semisolids such as spreads, salad dressings, condiments and sauces, ketchup, peanut butter and mayonnaise, for example, coming out of a can in an aerosol, just like shaving cream, will be easier to dispense and easier to store and undoubtedly will find great favor in the convenience market of tomorrow.

We already have some aerosols today, such as whipped cream which, in 1955, was sold to the extent of some 60,000,000 cans. In addition to the products which I have mentioned, there are certainly other individual products which will be on the market, such as dehydrated potatoes, potato cubes, and potato granules.

Innovations in packaging of many foods will take place which will avoid dishwashing. Even today we have some foods which are sold in disposable aluminum platters including frozen steaks, T.V. dinners, and muffin mixes which have built-in plastic "mixing bowls."

In addition to all these, however, I think that the biggest revolution to take place in the food industry will be something that we cannot yet define very well, because it is really in the test-tube stage. That relates to fundamental research on the chemistry and flavor of foods. Recently, a new rationale has been developed on certain enzymes which contribute to the flavor of foods and which are lost in the heat processing of foods.

But more important than this is the objective determination using latest techniques in physics and chemistry to characterize those compounds responsible for flavor of foods. What gives coffee the aroma that we like when we wake up in the morning? Why do we prefer charcoal broiled steak to steak broiled in an ordinary oven? What is there about fresh vine-ripened tomatoes that we prefer when they are available in July, August, and September, to the tomatoes shipped from down South during the middle of winter? Why is the flavor of banana differ-

(*Continued on page 264*)

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Full-scale cutaway model of 4-story high Shippingport reactor. The reactor vessel, indicated by the colored areas, was designed and built by Combustion. Model made for Westinghouse by Gardner Displays.

Today, commercial electric power from the atom is a reality in America. On December 2, 1957, the country's first full-scale atomic power plant... the Shippingport Station operated by the Duquesne Light Company...went critical. It began producing power December 18 and reached full power output 5 days later. Designed by Westinghouse Electric Corporation for the Atomic Energy Commission, this pioneer nuclear power plant is now in regular operation, supplying electricity to the Pittsburgh area.

Combustion Engineering was one of Shippingport's major suppliers. Its contribution: the heaviest unit of atomic power equipment ever built... the 235-ton reactor vessel—depicted by the colored areas in the picture opposite. This mammoth container houses the nuclear fuel charge within 8½-inch steel walls. More than 3½ tons of water pass through the vessel every second—at pressures of about 2,000 pounds per square inch—to carry off the tremendous heat generated by the nuclear reaction. Though it stands over three stories high, many of its massive parts were machined to watchmakers' tolerances. Entirely new fabrication and inspection techniques had to be developed to make such precision possible.

Combustion's activity in the field of nuclear power has ranged from such civilian projects as Shippingport and the Fast Breeder Reactor vessel for the Enrico Fermi Plant* to the design and manufacture of a complete submarine reactor system and numerous components for our nuclear Navy. C-E's highly specialized personnel and extensive facilities for nuclear work will enable the Company to occupy as important a place in the future use of atomic fuels as it has long held in the field of conventional power generation.

*Designed by Atomic Power Development Associates, Inc. for operation by Power Reactor Development Company

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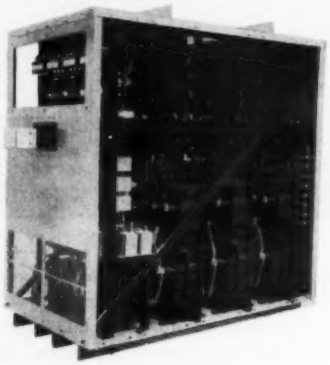

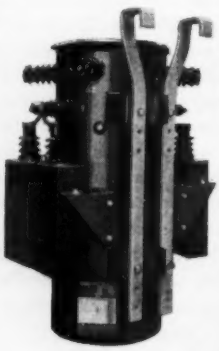

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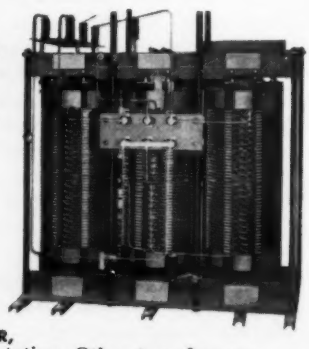

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TEST TUBE TO TABLE

(*Continued from page 262*)

ent from that of an orange? What contributes to the difference between ripe bananas and green bananas?

Today we have available a host of new techniques: vapor-phase chromatography, counter-current distribution, infrared spectroscopy, ultraviolet spectroscopy. These and many other techniques may unlock the secrets which are so tightly held by nature within the cellular membranes of foods – the secrets of the flavor molecule. We, as are other laboratories throughout the country, are extremely active in this area, and feel that when we are able to unlock these tightly held secrets of nature – of what flavor is in different foods – we will then be able to produce for the American public optimal foods in terms of flavor. This is, I think, the biggest revolution now in the test-tube stage in terms of research.

In addition to this, we are active in pursuing other objective means of evaluating food quality. We now have developed electronic equipment in our laboratories for measuring texture electronically and for measuring color electronically, as well as other physical attributes.

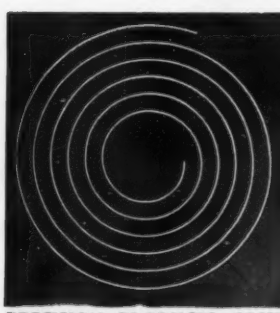
These, I think, are the important developments on the horizon today; and when I say horizons I literally mean that, for our two-week summer course for industry, given in the Department of Food Technology at M.I.T., is entitled "Horizons in Food Technology."

You may ask, what about the use of Chlorella? What about food yeast in our diets of tomorrow? It is true that these are being developed today beyond the test-tube stage and that they will provide some foods for undeveloped areas of the world.

For these undeveloped areas, there are other foods such as fish protein which will be available. But with the help of a divine Providence our standard of living will keep on increasing and our descendants probably will be just like you and just like me – still wanting to eat, in the year 2000, three square meals per day, preferably steak, chops, lobster.

There are many advances that science and technology will produce for us from the test tube of today to commercialization tomorrow. These advances will result in better life and better health for mankind through improved food and increased nutrition. If these things do occur, and we predict they may, it will be due in large part to the efforts of the food technologists who carry the new ideas to the

(*Concluded on page 266*)



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TEST TUBE TO TABLE

(*Concluded from page 264*)

test tubes, from there to the pilot plants and, eventually through production and distribution, to the American table.

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Addenda

"U.S. Food Market in Spring of 1955," *Food Processing*, **18**(3):26-27 (1957).

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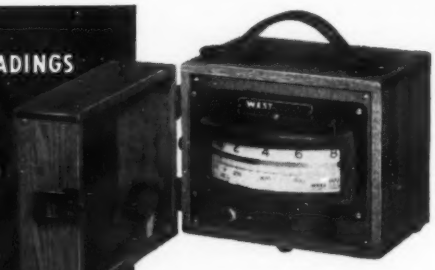

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ANSWERS TO SPUTNIK?

(*Continued from page 252*)

of graduate and postdoctorate research on a truly interdepartmental level with the principal needs of national defense. These centers should be devoted to broad fields of modern research and their long-range applications; the field of modern materials research, most familiar to the writer, is only one example. They would train graduate students and postdoctorate fellows, and simultaneously have postgraduate fellows from the Services rotating through on an annual basis. The work would be unclassified in keeping with university tradition and directed by a staff of outstanding experts ranging through all fields of science and engineering. This staff, while belonging to the faculty of the university, should be appointed by the center according to its needs with faculty approval. There will be no scarcity of excellent senior staff if we augment the younger generation with outstanding emeritus professors. The departments, in turn, will be strengthened by the influx of new talent which shares their teaching load.

A junior staff of corresponding excellence could be provided by revamping our antiquated draft system for the needs of this technological age. If a world war should ever break out again, it will be a desperate slugging match between the scientists and engineers of the contending nations, with the rest of the population as unhappy bystanders. The only sensible solution from the standpoint of preventive defense measures is therefore to let every student finish his

(*Concluded on page 270*)

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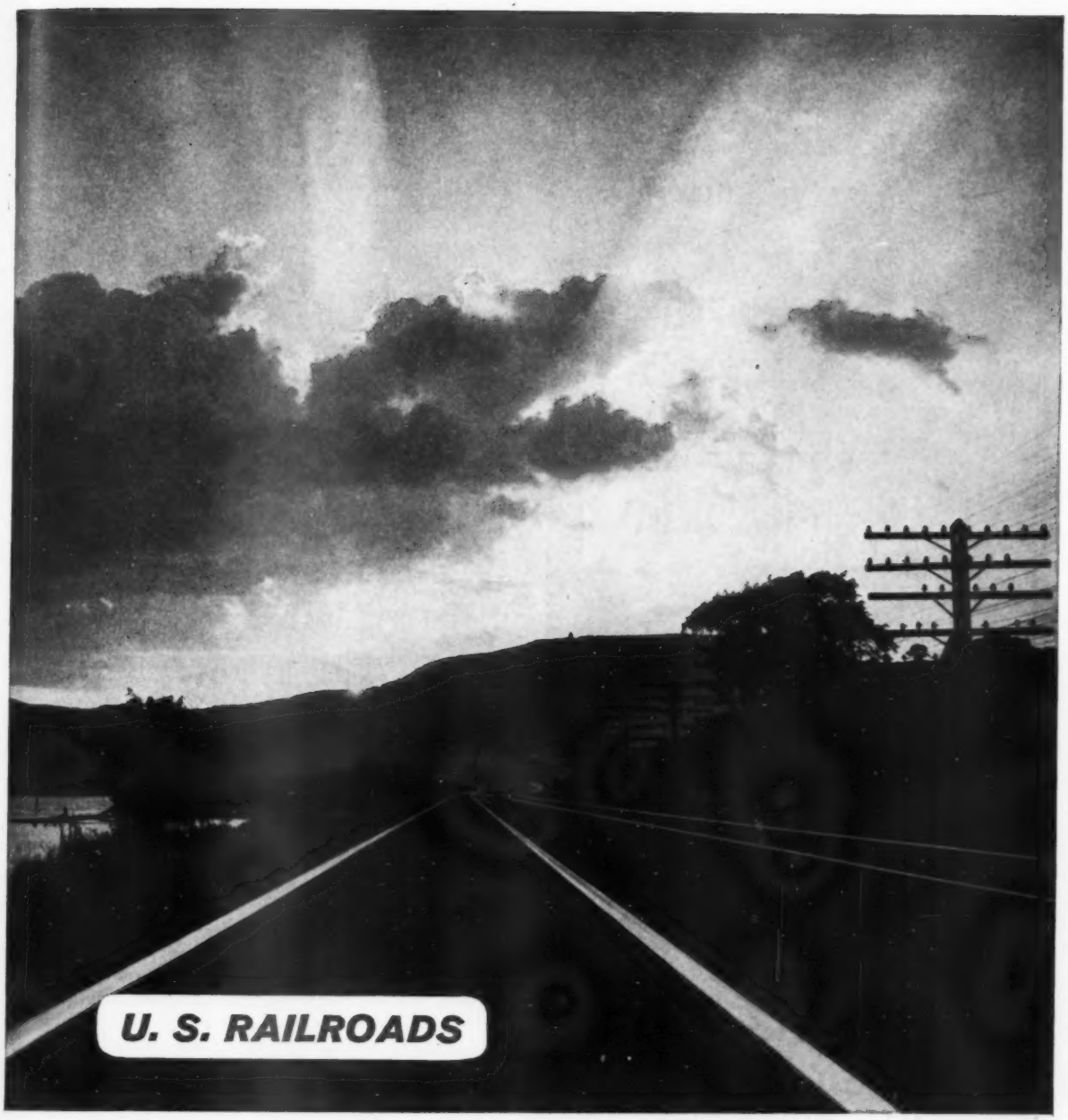

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ANSWERS TO SPUTNIK?

(*Concluded from page 268*)

education up to the highest degree for which he can qualify. These students should then be drafted for the services of their country with a competitive chance for positions in the federal research centers of the universities. Here they would contribute to the real defense strength by working on urgent research problems, helping in the education of the next generation, and acquiring in these years a thorough post-graduate training.

Such a program makes everybody the winner, including industry which would get much better men and competent advice when needed. Our inherent defense strength which rests on outstanding quality of men and weapons would be vastly improved; at last we would have also the information centers we need and not be caught napping again. This program should prove to be even self-financing by saving defense billions which are misspent now.

Emergency and Long-Range Planning

There is a desperate urgency in our present situation. Our adversary is politically much more cunning than we are and his technical strength is surpassing ours at a rapid rate. Shortly, we may be confronted with an ultimatum to surrender or be annihilated. This is the challenge, and against it our response has to be measured. How can a long-range program of creating federal research centers at the universities be justified on this basis?

In panic, at present we throw all available funds into the final production of missiles and rapidly antiquating hardware, while fundamental research is still starved for funds as before. We have to build new real strength into our nation. To create a number of prototype research centers at the universities or as regional centers for adjoining universities, under long-range guarantee by federal funds, will cost no more than one of the super-aircraft carriers we are building, and the task will take no longer to complete. While a carrier is of no value until launched and of doubtful value thereafter, the centers, already in their initial stages, can serve for information and advice, and later will be a mighty source for knowledge and defense. Our nation can still be safeguarded by scientists and engineers if they — not fettered by unessential tasks and red tape — are freed for an inspired effort combining emergency measures with long-range planning.

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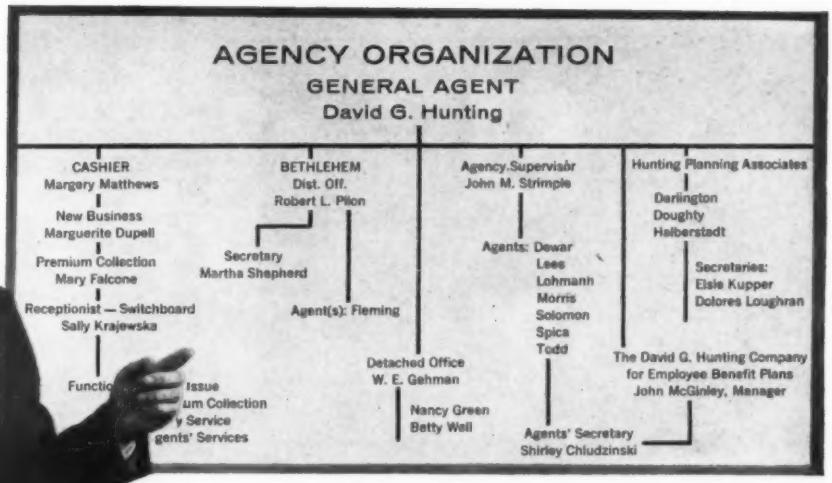

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New England Life's role in furthering a career is then essentially this: to provide latitude for individual expression in an atmosphere of full company support. And this holds true whether a man chooses a management career or prefers to develop a clientele of his own.

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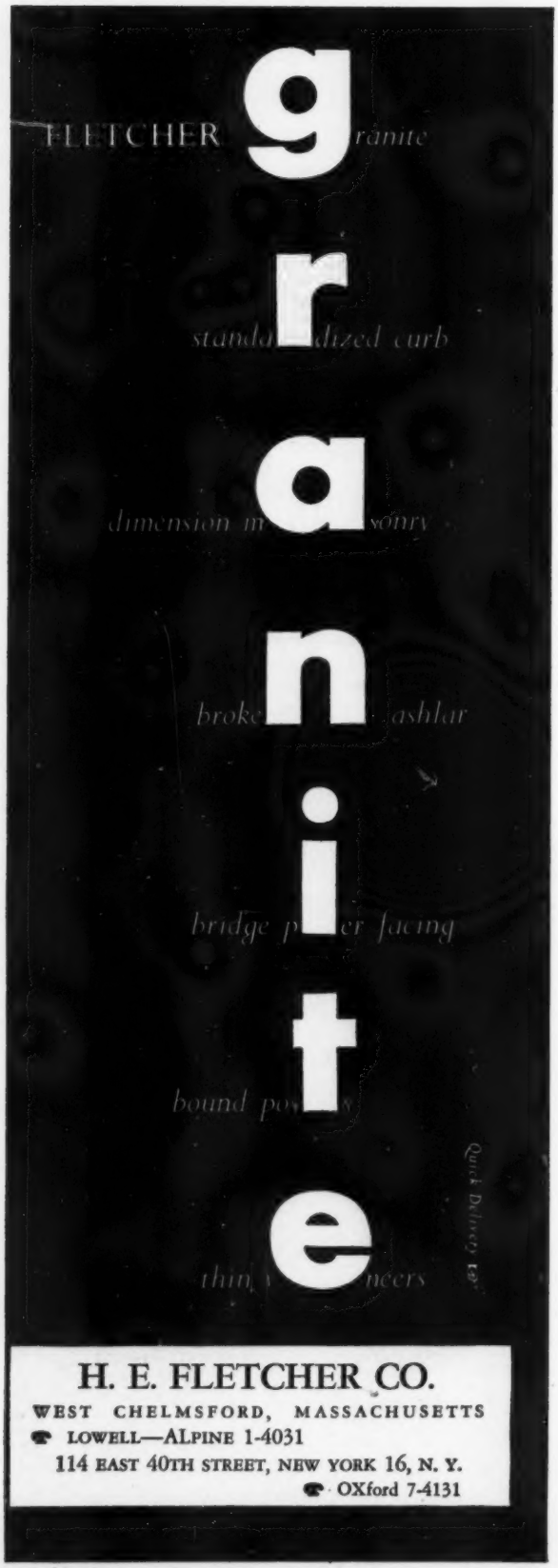

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TREND OF AFFAIRS

(*Continued from page 250*)

As part of the group of supplementary classroom aids which will be co-ordinated with the text, seventy 20-minute motion pictures on a wide range of physics topics are being prepared with the joint co-operation of Hollywood film producers and educators. A suburban Boston motion picture house, Loew's Watertown Square Theater (in Watertown, Mass.) has been leased by the Physical Science Study Committee for use as a studio in the production of these color sound films for classroom teaching. The films will be planned and written individually by leading physicists, including Nobel prize winners, at educational institutions and industrial laboratories across the country. Thus, a nationally recognized authority will be responsible for each film subject, although he will work in close association with professional motion picture men, producers, and writers.

While Hollywood producer-director Frank Capra will produce two of the films, the majority will be made by Encyclopaedia Britannica Films, Inc. By combining the efforts of a national committee of scientists and educators with the efforts of leading film producers, in the new revolutionary approach to teaching of high school physics, first-class physics teaching could become available to every high school in the nation.

Third speaker on this interesting program was John H. Marean, physics instructor in the Reno (Nev.) High School who took a year's leave of absence in order to work with the Physical Science Study Committee. Bringing to this program the point of view of the high school physics teacher, Mr. Marean described the reception the experimental program is now receiving in half a dozen schools which have voluntarily adopted the program for the current year. Next summer it is planned that about 250 high school physics teachers will meet at various universities throughout the nation to become familiar with the new program. From this core, it is hoped, the adoption of the new physics program can proceed somewhat more rapidly in the future. At present about a dozen private and public schools are participating in using and developing the new physics program. The private schools are less restricted in their programs of instruction than most public schools and are finding

(*Continued on page 274*)

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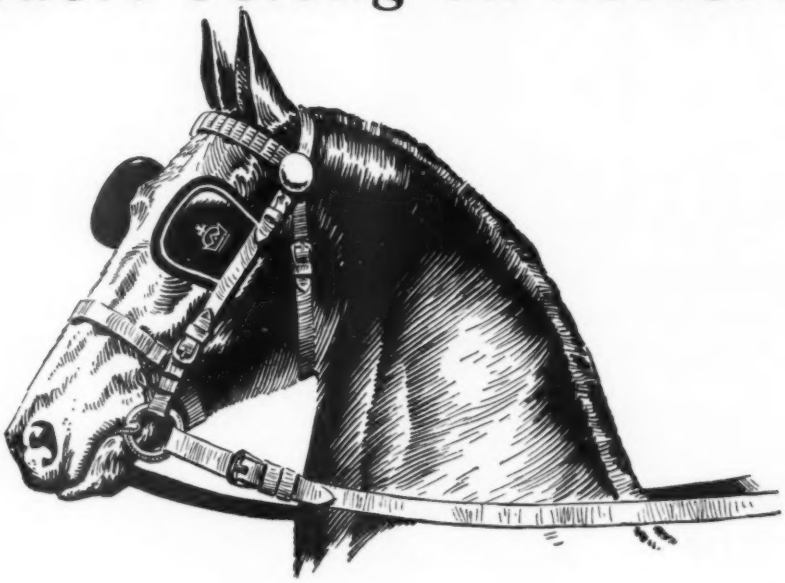

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TREND OF AFFAIRS

(Continued from page 272)

the new course a most stimulating one. Mr. Marean expressed his impatience to get back to his teaching post to try the effects of the program on students in the Reno High School.

In place of J. A. Stratton, '23, M.I.T. Acting President and Chancellor, who was prevented from attending because of a meeting in Washington, final speaker on the program was George R. Harrison, Dean of the School of Science at the Institute. Dr. Harrison spoke on the implications of the new teaching program, and suggested how Alumni and others might contribute to its further adoption and increased effectiveness.

Fall Athletic Résumé

■ As mentioned in the February issue of The Review, résumés of some of the 1957 fall athletic competitions have been prepared by the following members of the M.I.T. Athletic Association staff: Coach Charles Batterman, on varsity soccer; Coach Benjamin R. Martin, Jr., on freshman soccer; and Walter C. Wood '17, on sailing.

The résumés presented in this issue point out the fine spirit displayed by our Tech teams, which led to a most successful sports year for the Institute.

Soccer

Varsity – The varsity soccer team started practice a week and a half before school officially began. Through a plan initiated last spring, members of the squad and qualified freshmen were invited to come back early for pre-school practice. The response was fairly good. We practiced twice a day for one and a half hour sessions. This proved very helpful in many ways: I got to know the boys, none of whom I had met before; they got to know each other; and we worked on fundamentals.

What started as an apathetic group (not reporting to practice on time, and not reporting to practice at all) slowly became, as the days went by, a more responsible one. There was plenty of talent, and they were beginning to play together. Our first game at Amherst was the opening test of a tough schedule. At the start of this game, Tech controlled the ball for the whole first quarter but did not score; Amherst

(Continued on page 276)

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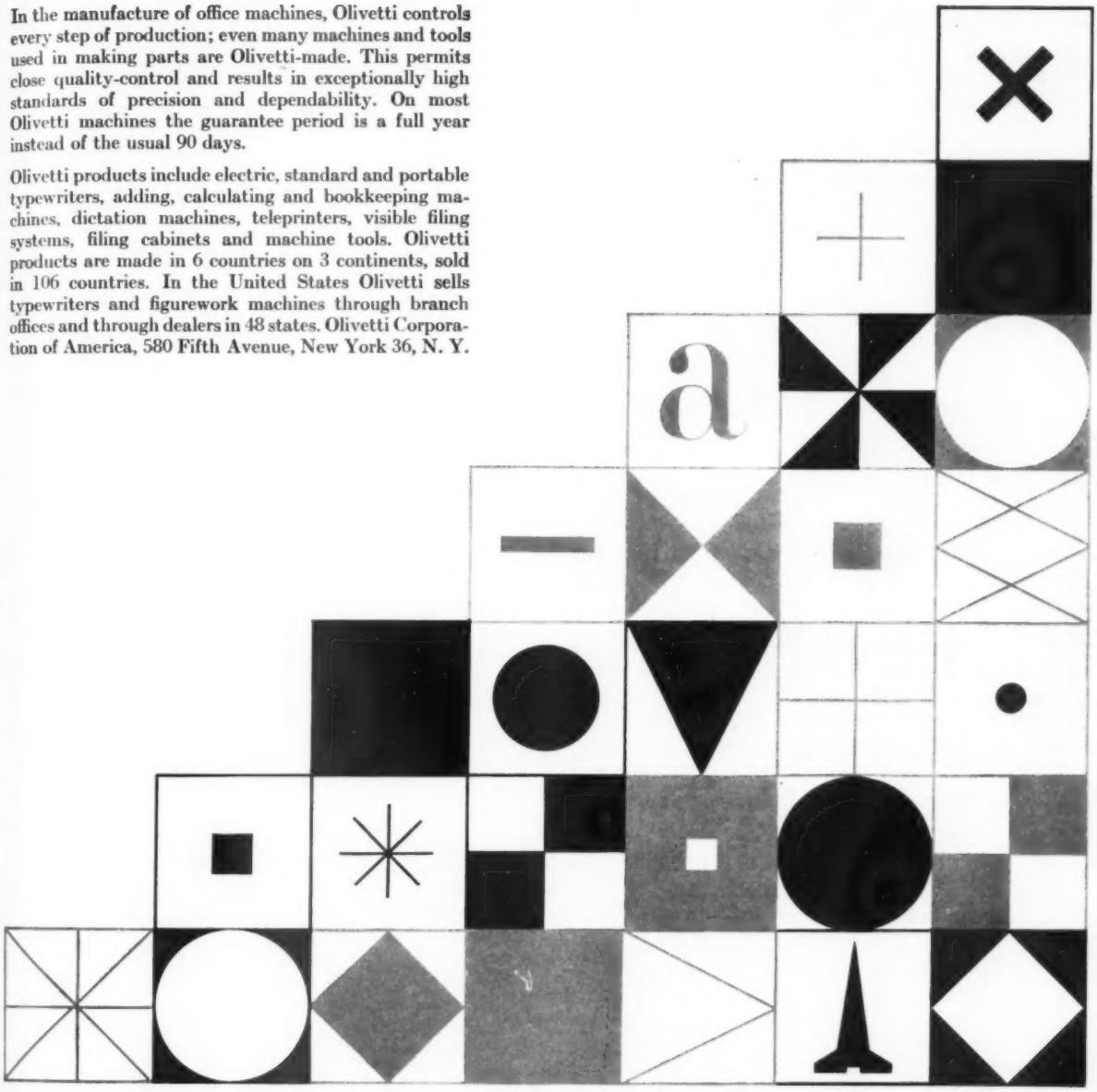

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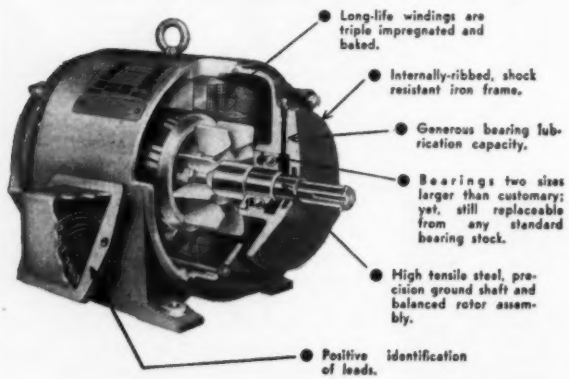
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TREND OF AFFAIRS

(*Continued from page 274*)

scored three quick goals before the half. We were down 3–0, and with one minute to go in the half, Manoel Penna, '60, scored. We came back after the half to score two quick ones, both scored by Kenneth Evans-Lutterodt, '60, to tie the game which went into overtime and ended in a tie. This was a crucial game and the boys were pleased at having had the ability to fight back and overcome a one-sided score.

We won the next six games, beating Worcester Polytechnic Institute, Boston University, Tufts, U.S. Coast Guard Academy, Harvard (this game saw superlative playing by everyone, particularly Rodolfo Segovia, '58, the goalie, and Sivavong Changkasiri, '58, fullback), and Brown; then losing to Springfield; and winning our final game against Dartmouth. In the final standing in the New England League, M.I.T. was second, behind Springfield, and ahead of Harvard.

The M.I.T. soccer team was composed of a very fine group of boys. They worked hard, practiced religiously, and had spirit and a strong team feeling. They were unique in their international composition, about 15 countries being represented (Ghana, Lebanon, all South American countries, Esthonia, Korea, Siam, and so on), and they got along very well with each other and with me. As a result of the publicity they received, we were invited to, and made, a tape recording for the Voice of America, which will spread the name of M.I.T. and M.I.T. soccer all over the world. The enthusiasm for soccer among the team members led to the formation of an active M.I.T. Soccer Club, which has endowed awards for outstanding players, and in general will do a good job in promoting and publicizing soccer at Tech.

Our captain-elect for next season, John H. Comerford, '59, was an outstanding player, a vital part of our defense, and is an outstanding boy. The forward line, composed mostly of sophomores, was the best I had seen in New England, and with more work on positional play and teamwork should be even better next year. The loss of our goalie, Segovia, and fullback, Changkasiri, will be felt.

This was a most successful season, not only record-wise, but also in the strong team feeling developed, and the interest shown in M.I.T. soccer by the players, the students, and many of the Faculty.

Freshman – The recently completed freshman soccer season again proved that there is nothing quite as important as high-grade material when it comes to establishing a winning team. The Beaver yearling booters skinned shins with seven opponents and won three, tied two, and lost two games.

Wins were recorded at the expense of Medford High School, Windham College, and Tufts Freshmen. Exciting ties were played with Harvard Freshmen and Phillips Exeter Academy. Losses were to Brown Freshmen (in overtime) and Andover Academy.

High point of the season was the unexpected win over Tufts Freshmen in the final game. In this contest

(*Concluded on page 278*)

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REMARKS: February 1, 1949 was the first day former Air Force Lieutenant Andrew Serros reported in as a New York Life representative at the Company's Jacksonville General Office. Since that day, he's compiled a sales record that speaks for itself. The first year on the job he qualified for the Company's Star Club—and for the President's Council in each succeeding year. From 1952 to 1957, he received the National Quality Award from the National Association of Life Underwriters. To cap all this success, Andy won a seat at last year's industry-wide Million Dollar Round Table. Behind this impressive record lies Andy Serros' sincere interest in his clients' insurance needs and enthusiasm for his job—two factors that could foretell even greater success for Andy with New York Life in the years ahead.

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TREND OF AFFAIRS

(*Concluded from page 276*)

the Baby Beavers tied the game in the last 20 seconds and won in overtime.

Sailing

The sailors, led by team captain William S. Widnall, '59, and C. Dennis Posey, '59, have had a successful fall season, winning the U.S. Coast Guard Academy Quadrangular, the Jack Wood Pentagonal, the Henry B. Nevins Trophy, the Erwin H. Schell Trophy, and the newly created Sloop Championship — sailed in Ravens at Coast Guard Academy. They finished fourth in the Danmark Regatta and third in the Oberg and War Memorial Trophy Regattas, all of which were won by Boston University sailors, who now have a fleet of Tech dinghies on the Charles River. M.I.T. finished third behind Brown and Yale Universities at Providence in the C. Sherman Hoyt Regatta, the only major event not won by Tech or Boston University.

During the summer months, Posey won the Massachusetts Bay Monotype Championship and, sailing under the Nautical Association burgee and with an all-Tech crew, captured the Benson Trophy, emblematic of the Senior Men's Championship of Massachusetts Bay. In the New England Championship, he lost by a single point to George D. O'Day who went on to win the Mallory Cup, emblematic of the Men's Senior Championship of the United States. Also during the past season, Posey won the Atlantic Coast Thistle Championship and, with coed Carol M. Dorworth, '60, as crew, sailed one of the Tech Fireflys to the North American Firefly Championship in a field of 27 boats at Seneca Falls, N.Y.

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and the prophet replied:
*"It is well to give when asked, but it is better to give unasked, through understanding."**

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The tale is told of Almustafa, the prophet, who, having awaited for many years the ship that would return him to the place from whence he came, was making the final descent to the shore when the folk of Orphalese crowded about him. They besought him before departing to "disclose us to ourselves, and tell us all that has been shown you of that which is between birth and death."

With words of wisdom, an answer appropriate was given to the woman holding a baby, to the ploughman, to the merchant. Begged one, "Speak to us of GIVING," and the prophet replied:

> "It is well to give when asked, but it is better to give unasked, through understanding;
> And to the open-handed the search for one who shall receive is joy greater than giving. All you have shall some day be given;
> Therefore give now, that the season of giving may be yours and not your inheritors'."

Through the years the prophet's words have held true, for even today he who "through understanding" includes the MASSACHUSETTS INSTITUTE OF TECHNOLOGY as a beneficiary in his will can experience thereby a two-fold satisfaction. The successful culmination of his search for a worthy recipient and the anticipated results his generosity will assist in accomplishing. These satisfactions give an added value to the span of man's days and project his usefulness to his fellowmen far into the future.

The Massachusetts Institute of Technology because of the high quality of the education given its students, its effective research work for aiding America in peace as well as in war, and the high character of its governing body and academic staff qualifies as an institution for serving our American ideals for the present and in the years to come.

But the search, the finding, and the anticipated accomplishments are not enough; for without the properly-worded record, man's plan for the future may go awry. Hence the prophet's importuning, "— give now," should be heeded. The giving need not be an immediate physical transaction, for written directions replace the spoken word when the speaker is no longer present, and a donor can frequently make by will a gift which is larger than he can make while living. Truly, *"it is well to give when asked, but it is better to give unasked, through understanding."*

A booklet "Gifts by Will," outlining different forms of bequests to M.I.T., is available to you or to your attorney by writing to:

Director of Development
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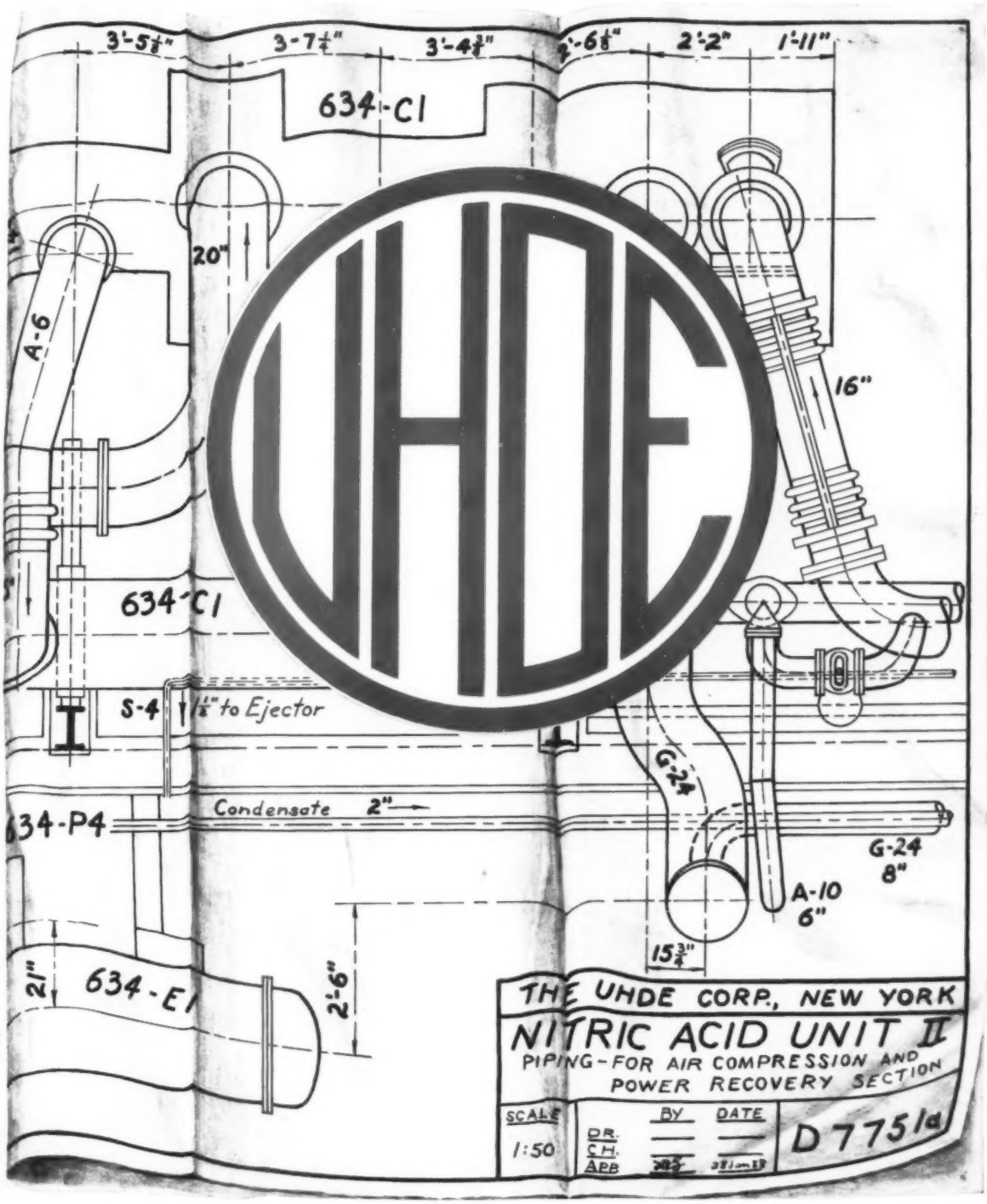
* "The Prophet" by Kahlil Gibran



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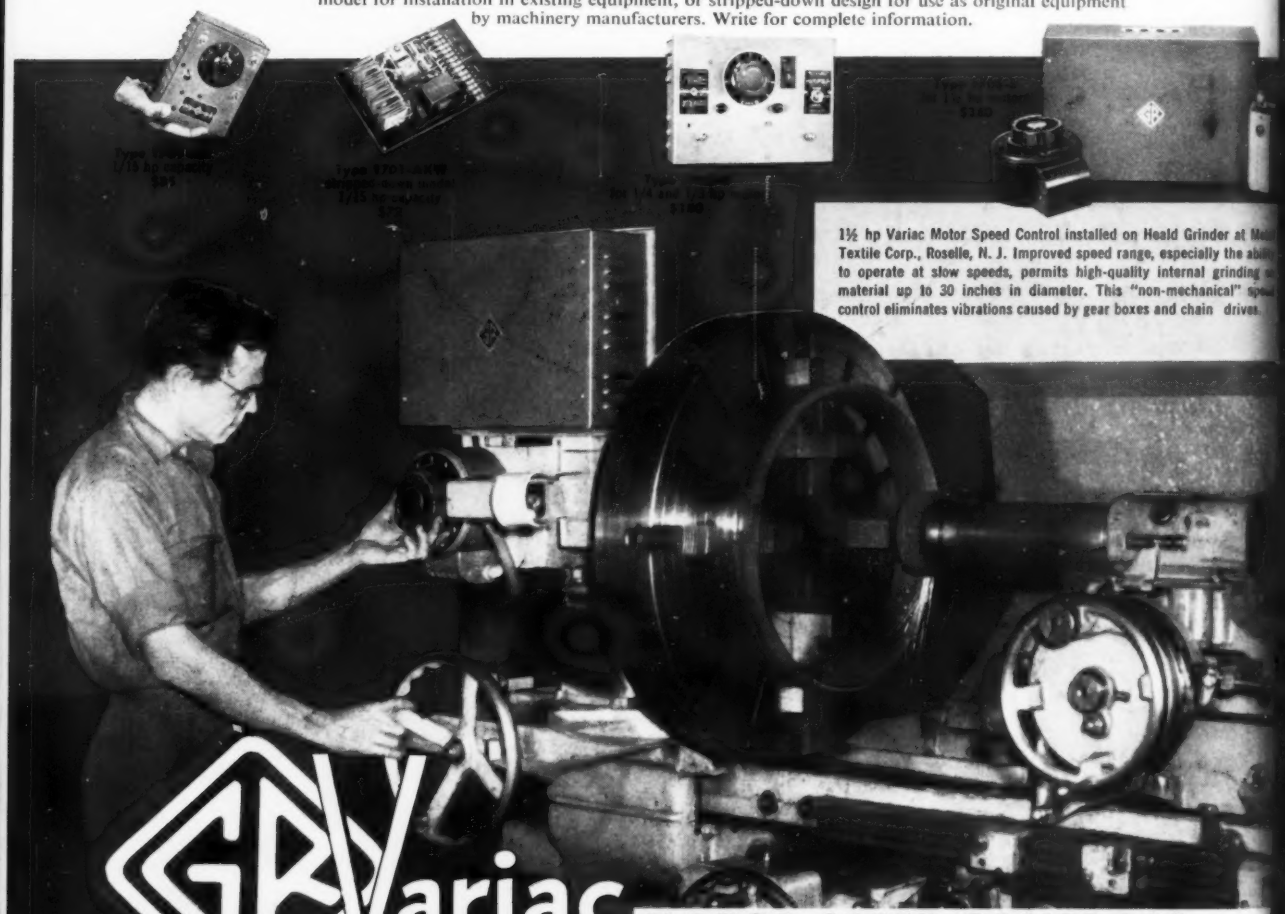

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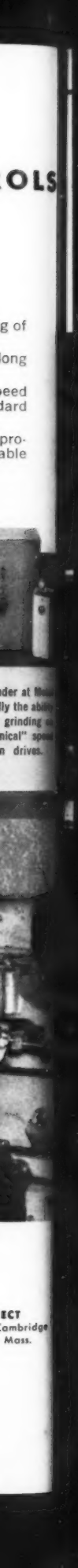
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